WILLIAMSWARN

THE WILLIAMSWARN PERSONAL BREWERY USER MANUAL

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INTRODUCTION

We are very proud to bring you the Generation 2 WilliamsWarn® Personal Brewery. The development of the first model that we launched with in April of 2011 took over 6 years of effort and determination. In the following 12 months after launch, we sold out of the first batch of 70 that we had produced. We learnt much from this first model and we had a rapidly growing international demand, so we decided to seek investment to improve the brewery and meet this response.

We received the investment we required in mid-2012 and then proceeded to develop the Gen2 WilliamsWarn, a new set of ingredients and this new User Manual.

Your personal brewery can deliver 23 Litres (6 US Gallons) of cold, clear, perfectly carbonated, commercial quality alcoholic beverages in 7 days, just like a modern brewery. It requires only about 1 hour of your time. The quality of the products produced was well and truly proven when a brewer on his 3rd brew in his WilliamsWarn, beat 45 of the world's biggest and brightest breweries to win a Gold Medal for his Pilsner at the Asia Beer Awards in 2012.

This User Manual is divided into four parts:

- Part One describes your Personal Brewery, how to set it up and some important safety information.
- Part Two describes how to make beverages using our Standard Method with our Standard Ingredient Kits. The final page contains our Short Instructions, which is all you will need once you have made several brews and the process becomes more intuitive.
- Part Three explains some techniques described as our Advanced Methods, which will enable you to produce unlimited beverage styles using some extra ingredients along with the Standard Kits.
- Part Four contains the Appendices and a Trouble-Shooting Guide.

We suggest you read this User Manual from cover to cover before you start to make your first brew, so that you are familiar with the process and timings involved. The Appendices are very important to read before you brew, because they explain the principles behind the Standard Method that you will use in Part Two.

Never has making a commercial quality beverage at home or the workplace been so easy. We promise that after using your Personal Brewery you will be as passionate about making beer, cider and other beverages as we are.

Thank you very much for your purchase and we sincerely hope you will love your WilliamsWarn from the very first brew.

Cheers.

Ian Williams

Anders Warn

PART ONE: YOUR PERSONAL BREWERY

BREWERY OVERVIEW

The following diagram shows an overview of the main components of your personal brewery. The unit comprises of two main parts: The Brewery Tower and The Brewing Vessel. The components of the tower and the brewing vessel are described in the following diagram. You will need to refer to this diagram whilst you are following the beer making instructions in Part Two.

Fig. 1

THE CONTROL PANEL

The control panel is where you control the brewing process from cleaning to dispensing the beer. The components on the control panel are described in the following diagram. You will need to refer to this diagram whilst you are following the beer making instructions in Part Two.

Fig. 2

1. 3-WAY VALVE
2. VESSEL PRESSURE GAUGE
3. CLARIFICATION POT
4. VARIABLE PRESSURE RELIEF VALVE (VPRV)
5. DIGITAL TEMPERATURE CONTROLLER
6. ON/OFF BUTTON
7. VESSEL LIGHT BUTTON
8. DRAFT TAP
9. DRAFT TAP FLOW CONTROL LEVER
10. BREWERY FILLING LINE VALVE
11. BREWERY CO_2 LINE VALVE
12. DRIP TRAY

SAFETY INFORMATION

These instructions for use outline general safety guidelines for the correct operation of the WilliamsWarn Personal Brewery System

Carefully read and understand this user manual before attempting to operate.

Never use the WilliamsWarn Personal Brewery for any purpose other than the Intended Purpose. Do not misuse, modify or force the appliance in any way as damage may occur that may create potential hazardous risks or situations.

Refer to the Part Two, Stage 1 instructions in this User Manual for the approved cleaning instructions of product before use.

Should the WilliamsWarn Personal Brewery appear to malfunction or observe failure of operation, contact your local approved service agent to arrange for repair. All repairs must be carried out by an approved and qualified service technician.

Do not use the brewery if there is damage to the product, power lead, gas bottle and regulator valve or the system has changed in performance.

Ensure the correct attachments and CO_2 regulator valve are used with the product.

1.1 INTENDED PURPOSE AND PERFORMANCE

The intended purpose of the WilliamsWarn Personal Brewery system is to deliver cold, clear, perfectly carbonated, commercial quality beer in 7 days, as in a modern brewery, requiring just over 1 hour of setup time. The Personal Brewery process involves the operator performing various tasks at specific times to produce a commercial quality beer in a domestic home environment or other establishment. Please note, the WilliamsWarn is not designed to be used in an outdoor environment and should be protected from rain and moisture ingress at all times.

1.2 COMPONENTS AND ACCESSORIES

The complete WilliamsWarn Personal Brewery includes:

A. The Personal Brewery

B. A bag of Sundry Equipment as laid out in Figure 6 in Part Two.

C. 3 of M8 x 20mm stainless steel set screws, to attach the beer font.

D. A funnel to enable the addition of a glycol mixture to the heating/cooling unit before use.

E. 4 Litres of 5% food grade glycol mixture to add to the heating/cooling unit before use.

F. Two stainless steel wheel chocks to prevent movement of the unit once positioned.

This user manual and a set of ingredients will be delivered separately to the brewery.

1.3 INSTALLATION, STORAGE AND OPERATING CONDITIONS

The WilliamsWarn Personal Brewery is suitable for operating in temperatures of 5°C to 40°C (41°F to 104°F) with a maximum allowable humidity of 90% (within the prescribed temperature range).

The WilliamsWarn Personal Brewery wheel chocks must be engaged to keep the appliance stable while in use. Do not move the appliance while it is in operation and only operate on a level surface.

The WilliamsWarn Personal Brewery shall only be used for human consumption. Do not use for storing animal product or other potential hazardous substances that will affect the performance and hygiene of the product.

1.4 CLEANING

Before cleaning the WilliamsWarn Personal Brewery make sure that the device is turned off.

Always clean following the instructions in this manual. Cleaning Instructions are described in Part Two, Stage 1.

We recommend the use of WilliamsWarn Brewery Detergent and WilliamsWarn Sodium Percarbonate as the detergent and sanitising agents respectively. If other products are used they should be approved brands of dishwashing detergent and approved brands of homebrewing sanitizer that are available commercially for these purposes.

Always use a non-scratch sponge so that the internal stainless steel of the vessel does not get scratched.

2.0 WARRANTY

WilliamsWarn provides a 1 year warranty on all parts and sundry equipment.

Warranty Disclaimer

The WilliamsWarn Personal Brewery is to be used only for human consumption only in accordance with the intended purpose 1.1. Use of the appliance not in accordance with these instructions will void the warranty and could cause potential harm and potentially severe health related issues.

3.0 MANUFACTURER DETAILS

The WilliamsWarn Personal Brewery is manufactured by:

Nanobrewing Ltd
1414, Omahu Road
Hastings 4175,
New Zealand.

www.williamswarn.com

4.0 APPROVALS

Z1696

C-Tick marked as supplier's declaration of conformity to the Radio telecommunications Act 1992 Section 182.

Importer Client Code: 4023 5041 F

Compliance:

AS/NZS 60335.1: 2011-A1:2012
IEC 60335.1:2011
Household and similar electrical appliances - Safety - Part 1: General requirements.

AS/NZS 60335.2.24: 2010
IEC 60335-2-24:2010 A1:2012
Household and similar electrical appliances - Safety - Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers.

AS/NZS 60335.2.21:2002
IEC 60335-2-21 ed6.0
Household and similar electrical appliances - Safety - Particular requirements for storage water heaters

AS/NZS 60335.2.34: 2003 A2
IEC 60335.2.34:2012: 2012
Household and similar electrical appliances - Safety - Part 2-34: Particular requirements for motor-compressors.

AS/NZS 3350.2.41:1997
IEC 60335-2-41 Ed 3.2
Safety of household and similar electrical appliances - Particular requirements – Pumps

RoHS 2011/65/EU
Restriction of the use of Hazardous Substances Directive in electrical and electronic equipment

WEEE 2002/96/EC
Waste Electrical and Electronic Equipment Directive

Food Safety Regulations

Food hygiene Regulations 1974 AS/NZ
AS/NZS 4020 Products for use in contact with Drinking Water
AS 2070-1999 Plastic materials food contact use

5.0 ANNEX I - ELECTROMAGNETIC EMISSIONS

For electromagnetic emissions the WilliamsWarn Brewery has been tested for compliance to AS/NZS CISPR14-1 Ed.5.1 (2009) Class B.

5.1 WARNINGS:

⚠ Use of accessories, cables and ingredients other than those specified and sold by the manufacturer as replacement, may result in increased emissions or decreased immunity of the WilliamsWarn Brewery.

Check if the voltage indicated on the appliance corresponds to the local mains voltage before you connect the appliance.

Do not use the appliance if the plug, the mains cord or the appliance itself is damaged.

⚠ This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities or lack of experience and knowledge unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

5.2 CAUTION

⚠ This appliance is intended for household use only. If the appliance is used improperly or for professional or semi-professional purposes or if it is not used according to the instructions in the user manual, the guarantee becomes invalid and WilliamsWarn refuses any liability for damage caused.

5.3 ADJACENT EQUIPMENT

The WilliamsWarn Brewery should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the WilliamsWarn Brewery should be observed to verify normal operation in the configuration in which it will be used.

5.4 OPERATION IN WET AREAS

Keep the WilliamsWarn Brewery clear from wet areas when it is placed and connected to the mains supply. Do not attempt to use WilliamsWarn Brewery for other purposes or move the appliance while operating. Keep the WilliamsWarn Brewery clear from wet areas.

6.0 TECHNICAL INFORMATION

1. Product Title / Trademark
   WilliamsWarn® Personal Brewery
2. Model No. / NB23-1
3. Vessel Volume (V)
   23 Litres (5 Imp. Gallons/6 US. Gallons)
4. Mains Input voltage
   220~240Vac
5. Mains Frequency
   50-60Hz
6. Supply Current
   0.8 Amps
7. Power Loading
   180 Watts
8. Heating Element
   240Vac, 80 Watts, 0.36Amps

9. Refrigeration compressor
   240Vac, 180 Watts, 0.75 Amps
10. Insulation classification
    Class I
11. Nett Weight
    87 kg
12. Enclosure IP rating
    IP22
13. Humidity
    10% - 90%
14. CO_2 Max Gas Pressure PS
    300kPa – 3Bar
15. CO_2 Regulated Pressure
    50kPa – 300kPa / 0.5 –3Bar
16. Operating Temperature TS
    5°C – 40°C (41°F to 104°F)
17. Refrigerant
    R134a
18. Refrigerant mass
    131g
19. Refrigerator Climate Class
    SN - T
20. Atmospheric pressure
    86kPa – 106kPa
21. Fermentation Temperature
    10-26°C (50-79°F), 50kPa – 300kPa, 0.5 – 3Bar
22. Refrigeration Temperature
    2°C (35.6°F)
23. LED Lamp
    12Vdc, 20mA

7.0 OTHER INFORMATION

These instructions for use outline general safety guidelines for the correct operation of the WilliamsWarn Personal Brewery System

Place the WilliamsWarn Personal Brewery upright on a flat, even and stable surface. Make sure it doesn't block a passage.

⚠ Take care when moving the brewery. The wheels on the base allow the user to move the brewery on a flat surface in a straight line. Take care when moving the machine in another direction.

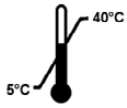
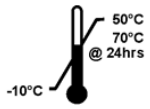
⚠ The refrigeration system will emit warm air from the ventilation ducts on the Brewery Tower. Ensure adequate air flow for the ventilation system so that air is not blocked or looped back.

⚠ Clear all spills from the surrounding floor in order to maintain hygiene. Clean the drip tray regularly.

⚠ The brewery tower panels may be removed for maintenance. Ensure only an approved service agent has access to the internal parts in the brewery tower.

⚠ Do not try to open the tank lid or valve (or take sediment bottle off without closing the tank valve) while under pressure. Always relieve pressure before opening the tank. Check the variable pressure relief valve (VPRV) regularly to ensure that it is not blocked.

8.0 SYMBOLS AND DEFINITIONS

	Fragile. Handle with care.
	Operate within 5°C to 40°C with a maximum allowable humidity of 90%
	Store and transport within the temperature range of 10°C (50°F) to 50°C (122°F) and 70°C (158°F) for 24 hours.
	Material can be recycled.
	C-Tick marked as supplier's declaration of conformity to the Radio telecommunications Act 1992 Section 182
	Read instructions before use
LOT	Lot number
SN	Product Serial number
	Date of manufacture
	This appliance is compliant to Restriction Hazardous Substances Directive RoHS 2011/65/EU in electrical and electronic equipment with the WEEE Directive. Under the European Directive 2002/96/EC this electrical appliance must not be disposed of to normal waste. Disposal: Extreme care must be taken when disposing of your old appliances to avoid hazards. The refrigerant gas must be safely removed. Your authorised repairer will be able to give advice on environmentally friendly methods of disposing of your old appliance.
IP22	This appliance is compliant to Restriction Hazardous Substances Directive RoHS 2011/65/EU in electrical and electronic equipment Ingress protection IP22: Note: Protected against solid objects greater than 12.5mm, Protected against dripping water from 15° from vertical: limited ingress may occur.
	Electrical Hazard, entry by qualified service personnel is required.

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SETTING UP YOUR PERSONAL BREWERY

Please follow the instructions below carefully to set up your Personal Brewery.

THE INGREDIENTS AND THEIR STORAGE

You will receive a set of ingredients and this user manual in a separate delivery to the brewery. You must use this set of ingredients for your first brew. An example is shown in Figure 5 (Part 2 of this manual).

Liquid Malt Extract (LME) ages over time and this can affect the beer flavour. We keep all our LME cold until shipment to you and ask that you continue this refrigerated storage policy until the evening before use. So any LME you have needs to be refrigerated until the evening before brewing, after which time it should be put on a bench overnight, so that it can warm up to room temperature before opening the next day. This will make it easier to pour. You can also warm the can up in hot water for 10 minutes prior to use if you forget to take it out of the fridge.

Dry Malt Extract (DME) does not need refrigeration so can be kept at room temperature indefinitely. Keep it preferably in a cool and dry area.

The clarification agent should not be kept below 5°C (41°F).

UNPACK THE BREWERY

Remove the protective cardboard packaging when you receive your brewery.

Unscrew the four screws that attach the brewery to the pallet and remove the brackets from their internal slots.

IMPORTANT: Keep the protective packaging, the pallet, the screws and brackets in a safe place for possible future use if the brewery needs to be shipped to a service agent for maintenance.

REMOVE THE EQUIPMENT STORED IN THE VESSEL

As well as your Personal Brewery, you have received some equipment which has been placed inside the vessel during transportation. This includes:

A. The Sundry Equipment to help you brew as shown in Figure 6 (Part 2 of this Manual)

B. The Sediment Bottle and its neoprene cover

C. The Draft Tap Font as shown in Figure 3A

D. 2 x U-shaped stainless steel wheel chocks as seen in Figure 4A.

E. An electrical cord to connect to your brewery and your electrical power source.

F. The drip tray.

Undo the vessel lid and unpack all these items.

POSITION THE BREWERY

Position your Personal Brewery in a place where it can remain for the duration of the brewing process and beer dispensing period. IMPORTANT: this will need to be on a flat level surface.

The brewery is on four wheels which will enable you to push the brewery unit in a straight line. They are not castors so in order to change direction you will need to lift or drag the front or back around to suit the direction that you require.

To fix the brewery into position, please slide the wheel chocks around the two front wheels, see Figure 4A.

This will prevent the brewery from being pushed around.

It is preferable to keep the unit away from direct sunlight.

For electrical safety reasons the unit must be kept out of the rain or wet area's so is not suitable for positioning outside in an uncovered area.

It is preferable that the unit is maintained in an ambient environment between 5°C and 40°C (41°F to 104°F) and less than 90% humidity.

Remove the white protective wrap from the stainless steel by pulling it off with your hands. It should peel off easily and reveal clean stainless steel.

Position the unit so that there is adequate air-flow through the air ducts at the base of the brewery tower. This is to enable the refrigeration system to work properly. It is important that the ducts are not blocked in some way or that the air flow does not loop back on itself. The area around the ducts may become warm at times.

ACCESS TO MACHINE INTERNAL PARTS AND SERVICING

IMPORTANT: READ THIS SECTION CAREFULLY

We have carefully designed and constructed this machine so that if necessary the user can access the internal parts of the brewery if required. On initial set up of the brewery you will be required to access this area.

Before accessing the rear protective panel you must ensure that the brewery is not connected to the mains power supply.

In the future, should you need to access this area after the gas cylinder is connected, you should also ensure that the CO_2 cylinder is turned off at the cylinder and the pressure in the tubing on the low pressure side has been released.

For the regulators supplied by WilliamsWarn to release pressure on the low pressure side, wind the regulator knob out anti-clockiwse to its closed position and the low pressure gas will release itself.

Other than installing the components required to make the brewery functional it is not envisaged that the user will be required to access this area and you should not attempt to make any alterations, modifications or repairs to the machine without the strict guidance of the supplier/manufacturer.

All warranties will be void if the above process is not followed.

INSTALL THE DRAFT BEER TAP FONT

Install the draft beer tap font as follows:

1. Remove the draft beer tap font from the bag of sundry items that is inside the brewery vessel. See Figure 3A
2. At the base of the font are two John Guest fittings and three M8 bolts, the fittings have been installed and tested with the unit prior to removal for transport, please do not loosen or adjust them as it could affect the performance of your brewery. The three M8 x 25mm bolts can be removed from the base ready for reinstallation. See Figure 3B.
3. Remove the rear protective panel from the unit by turning the latches with a screwdriver and remove, see Figure 3C. IMPORTANT: Please ensure that the brewery has not been connected to the mains before removal of the protective panel, if it has please turn off and unplug before proceeding.
4. Once the panel has been removed, locate the draft beer font over the holes provided in the top of the beer tower and install the three M8 x 25mm bolts back into the base of the font firmly. See Figure 3D.
5. You are now ready to install the beer line and the CO_2 lines into the beer font. There are two available lines inside the beer tower. One has an insulated sleeve over it and the other is a black ¼" tube. The one that has an insulated sleeve is the beer line and the black tube is the CO_2 line.
6. To install the beer line, slide the insulation back to expose the end of the tube and press it firmly into the centre fitting on the underside of the beer font, see Figure 3E. Check to make sure that it is installed properly by pulling it gently to make sure it is locked in. The beer line is now installed.
7. To install the CO_2 line push the black tube firmly into the other available fitting at the rear of the font, and check by pulling it gently to make sure that it is locked in. See Figure 3F.
8. Leave the back protective cover off for the next step of filling the glycol tank for the heating cooling system.

INSTALL THE GLYCOL INTO THE HEATING COOLING UNIT

Install the glycol into the heating cooling tank as follows:

1. Remove the large rubber bung in Figure 3G with a screwdriver or similar so that you can access the slot in the foam insulation above the glycol tank.
2. Insert the funnel supplied through the slot in the insulation so that you can pour liquid down the funnel. Figure 3H.
3. Take the 4 Litres of 5% glycol mix supplied and carefully pour down the funnel into the tank. See Figure 3I.
4. Replace the rubber bung and wipe off any spillage.
5. Replace the rear protective panel and turn the latches back into position with a screwdriver to secure. See Figure 3C.

Fig. 3A

Fig. 3B

Fig. 3C

Fig. 3D

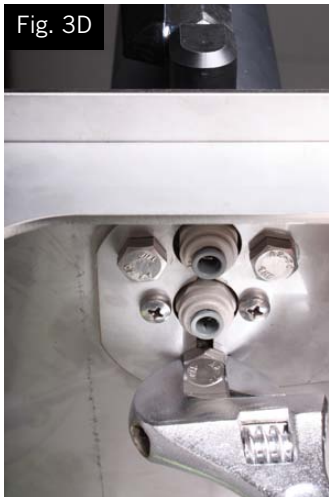


Fig. 3E

Fig. 3F

INSTALL THE LARGE GAS CYLINDER

You need to install a large food grade carbon dioxide gas cylinder inside the Brewery Tower as shown in Figures 4B and 4C. Such bottles can be:

A. Bought new from WilliamsWarn

B. Bought from other suppliers new or second hand

C. Rented from a gas supply company.

A gas regulator is supplied with the brewery and is inside the tower door.

Follow the next steps:

1. Ensure the 3-way valve on top of the control panel is in the closed position (X-mark).
2. Ensure the gas cylinder valve is closed (item 6 in Figure 4C).
3. Strap the gas cylinder into the tower as shown in Figure 4B.
4. Take the gas cylinder regulator and check the regulator is wound right out so that it will not supply pressure when connected to the cylinder. For the regulator that WilliamsWarn supplies, turn the knob (item 4 in Figure 4C) anti-clockwise until the end-point—which is its fully closed position.
5. Screw the regulator onto the gas bottle tightly with a crescent (or spanner or wrench).
6. Check the black gas line coming through the stainless steel back panel is connected into the regulator. For the regulators supplied by WilliamsWarn, this is a push-lock fitting on the regulator as shown in Figure 4C. Push the black line in hard into the push-lock fitting to ensure a good seal (item 5 in Figure 4C).
7. Then open the gas cylinder valve. The high pressure gauge on the left should then read the pressure of the cylinder. Check for any sound of leaking gas.
8. Then wind the regulator knob to achieve a reading on the low pressure gauge (on top of the regulator in Figure 4C) at 1.25 bar. This is the setting we suggest for first-time users. Check for any sound of leaking gas.

Your gas system is ready for use.

The 3-way valve on the control panel dictates whether this gas pressure is closed (the X mark), connected to the clarification pot (in-line with the arrow to the pot) or connected to the vessel (in-line with the arrow to the vessel pressure gauge).

When you need to replace a bottle:

1. Close the gas cylinder valve
2. Wind out the regulator knob to remove pressure on the low pressure side.
3. Unscrew the regulator from the gas cylinder and take the empty bottle to be refilled at your local agent.
4. Reconnect the full bottle as described above.

TESTING THE FONT INSTALLATION.

1. Ensure the vessel lid seal is sitting correctly into the vessel rim groove as shown in Appendix 4 and close the vessel lid firmly.

Fig. 3G

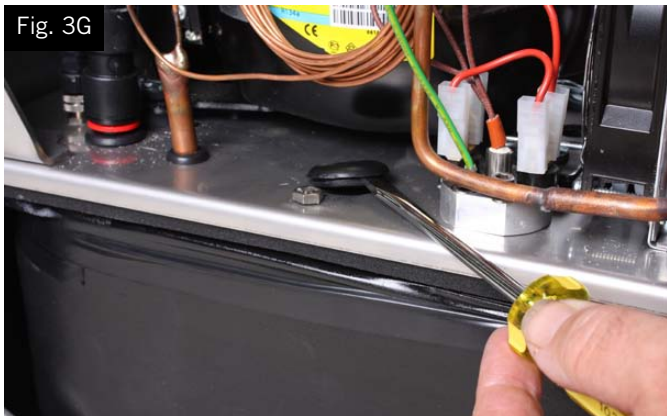


Fig. 3H

Fig. 3I

Fig. 4A

Fig. 4B

2. Check that the gas cylinder valve is open and check to see that the CO_2 regulator is set to 1.25 bar as read on the regulator low pressure gauge.
3. Check the draft tap is closed and the flow control lever on the side of the tap is pushed all the way up to its closed position. The draft tap should be automatically closed by its spring, which is its central sitting position (Not sitting forward and not sitting back).
4. Turn the 3-way valve clock-wise to the vessel pressure gauge arrow and once the vessel low pressure gauge reaches 0.25 bar turn the 3-way valve back to the X position. The pressure in the tank will drop down once you close the 3-way, and you will need to open and close the 3-way a few times to get a final steady reading of 0.25 bar with the 3-way valve closed. If the beer and CO_2 lines have been correctly installed then the system should then hold this pressure. If the gauge drops immediately then it is possible that one of the connections is not pushed in correctly. This will need to be checked by firstly following the ACCESS TO MACHINE INTERNAL PARTS AND SERVICING for your safety and then removing the rear protective panel again. Re-check the connections and make sure they are locked in to the push-lock fittings as described above.

CONNECT TO ELECTRICAL MAINS

Connect the electrical cord supplied into your brewery and then plug in your unit to a standard 230V 50-60Hz AC mains and press the green on/off button on the front of the unit. This will start up the glycol pump and the unit will start heating or cooling. Check to see that the vessel temperature (the larger number) on the digital display is similar to the ambient room temperature and then set the controller temperature (the smaller number on the digital display) to 2°C using the temperature adjustment buttons as shown in Figure 66 in Appendix 6. This will turn on the refrigeration compressor and will start cooling the cone portion of the vessel. A small yellow indicator will appear on the display and read, SUB2. Within minutes you should be able to check this as the vessel temperature, as read on the display, will start dropping towards the set point.

To check the heating, press the temperature adjustment buttons to increase the temperature set-point to 5°C above the actual vessel temperature. This will engage the heating element and a small yellow indicator will appear on the digital screen and read OUT 1. Within minutes the vessel temperature on the digital display will start rising towards the set point.

The brewery is now set-up and ready for brewing.

Press the green on/off button and turn the brewery off.

GENERAL AREA CLEANLINESS

It is optimal to maintain a clean area around the brewery. It is natural and expected that you will spill beverage around the unit as time goes by. Maintain a clean area around the brewery and wipe drips from the surface of the brewery as much as possible. Bacteria will start to grow on spilt beverage and it is always best to reduce any risk of infection in your beverages by keeping a tidy and dry brewing area.

Fig. 4C

1. HIGH PRESSURE GAUGE
2. SAFETY VALVE
3. LOW PRESSURE GAUGE
4. REGULATOR KNOB
5. LOW PRESSURE GAS CONNECTION
6. GAS CYLINDER VALVE

IMPORTANT: AVOIDING A MAJOR SPILL

During fermentation, the pressure will build up in the vessel. This is how the beverage becomes carbonated. There is a risk of a major spill if the draft tap is open and the flow control lever is open after the ingredients are added and fermentation is started. In this situation as the pressure builds up just a little, most of the 23 Litres (5 Imp. gal/ 6 US gal) of beverage will pour out the tap and onto the floor.

As described clearly in the Instructions, when you are brewing or when you have finished pouring beverage, you must ensure the draft tap is in its closed position. When pulled forward, the tap is open and when pushed back it is also open (the foam mechanism) so it must sit in its neutral position to be closed. A new tap should always spring back to its closed position, but a tap that is not cleaned adequately can start to build up sticky grime and may stick out from its closed position. Children or guests can also open the draft tap by accident.

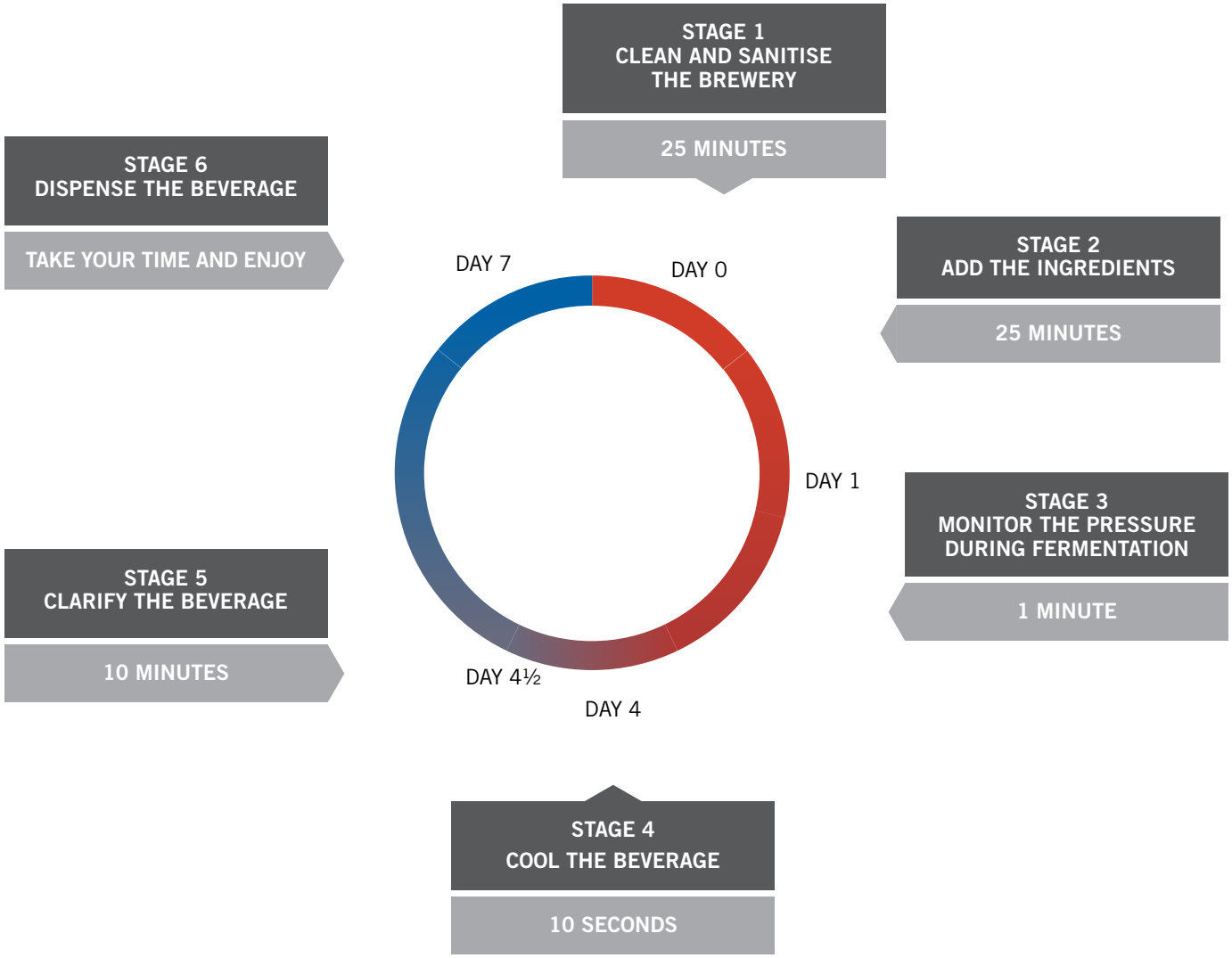
In any case, to avoid a major spill, unless you are pouring beverages as intended, the flow control lever on the side of the draft tap MUST BE PUSHED UP ALL THE WAY TO ITS FULLY CLOSED POSITION in order to ensure that there will be no leaking out of the draft tap, even if it is somehow not fully closed. In addition, it is important to check the draft tap itself is also in its closed position. In this way the tap is closed by two means and the risk of a major spill is reduced.

WILLIAMS WARN

PART TWO: MAKING YOUR BEVERAGE WITH THE STANDARD BREWING METHOD

BREWING CYCLE OVERVIEW

As shown in the overview below, ales (with an alcohol % up to about 6%) will be ready in 7 days, requiring about 1 hour total work time. Each Stage has its own set of corresponding instructions within this section of the user manual. The bulk of the work occurs at the start of the process when you are working through Stages 1 and 2.



Ales of a higher alcohol content may take a day or two longer as more fermentation time is required.

Lager yeast grow a little slower than ale yeast and are fermented at colder temperatures also, so lagers take about 2 days longer to ferment out compared to ales. Standard lagers therefore require a 9 day process in general.

For more details see the ale and lager fermentation charts in Appendix 7.

THE BREWING PROCESS: WHAT YOU NEED

Before you start brewing, it is important that you are fully stocked with the equipment and ingredients you need to make the perfect beverage. To get you started we have provided you with a starter pack of sundry equipment which will assist you in making great products. We have also provided you with a starter pack of ingredients for you to make your first beer with your WilliamsWarn Personal Brewery. You will also need to provide some basic equipment which you should find in your kitchen. Make life easy and lay all these pieces of equipment as shown in the next three photographs out on a bench before you start to make your beer. Best of luck and enjoy the brewing process!

Fig. 5

WILLIAMSWARN INGREDIENTS

1. 1.7KG LIQUID MALT EXTRACT CAN

2. 1KG DRY MALT EXTRACT PACK

3. YEAST SACHET (UNDER THE CAN LID)

The liquid malt extract can and yeast (under the can lid) should be kept refrigerated until near to brewing time. Ideally the malt extract can should be removed from the refrigerator the day before brewing so it can warm up to room temperature for better pouring, but alternatively a cold can may be soaked in hot water for 10 minutes before opening. The yeast can be removed from the fridge when you start cleaning your brewery.

Fig. 6

WILLIAMSWARN SUNDRY EQUIPMENT

1. BREWERY DETERGENT

2. SODIUM PERCARBONATE

3. 2 LITRE PLASTIC JUG

4. NON-SCRATCH SPONGE

5. 500ml RINSE BOTTLE

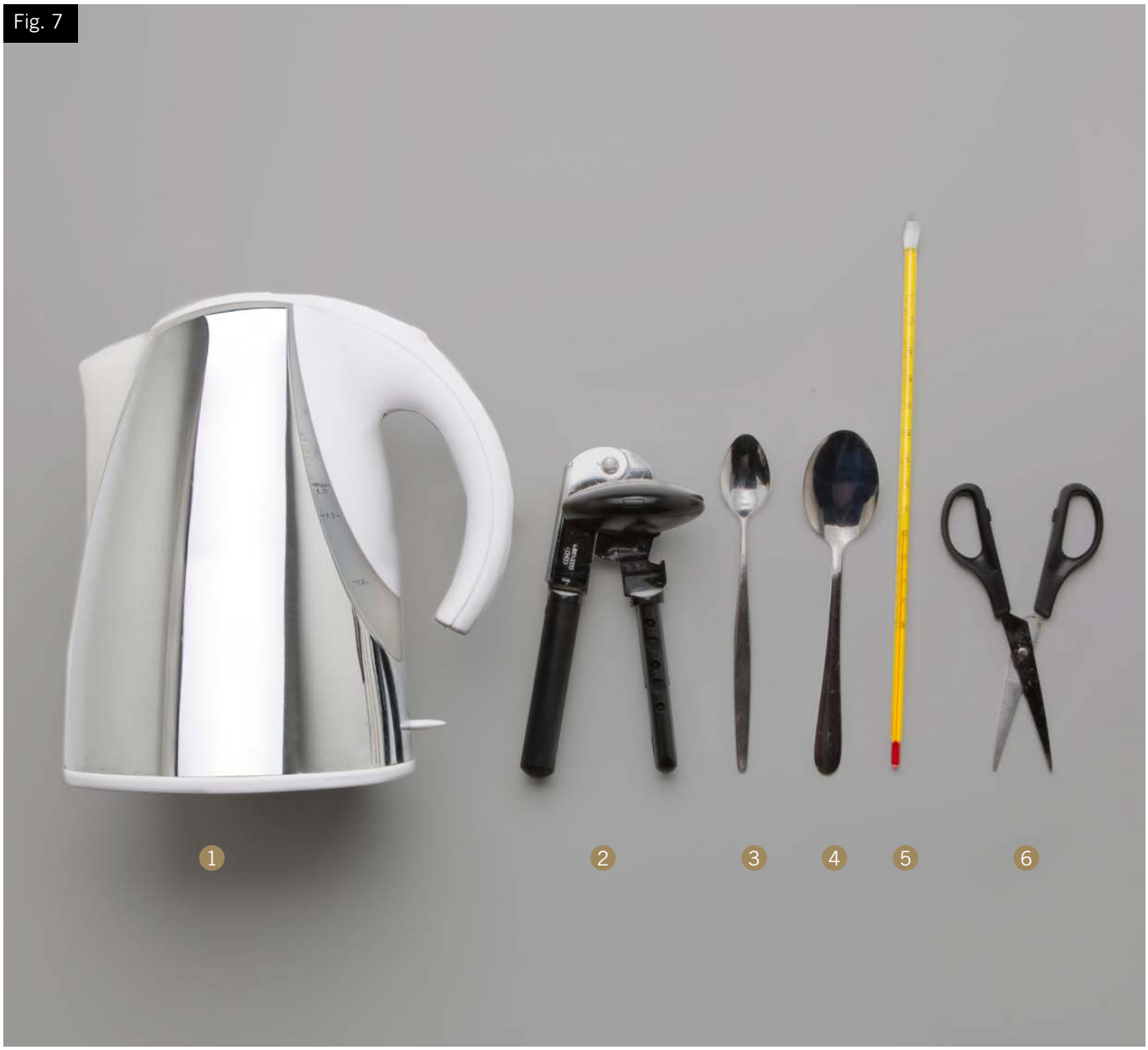
6. A LARGE SPATULA

7. 100ml CYLINDER

8. HYDROMETER

9. CLARIFICATION AGENT

Fig. 7



EQUIPMENT FROM YOUR KITCHEN

1. KITCHEN KETTLE

2. CAN OPENER

3. TEA SPOON

4. TABLE SPOON

5. THERMOMETER

6. SCISSORS

You will also need a source of cold water and a sink to dump waste into.

STAGE ONE: CLEAN AND SANITISE THE BREWERY

Please ensure you have studied Figures 1 and 2 and are familiar with the names of each component on your brewery. Please read Appendix 1 first, for background information and principles regarding cleaning and sanitising your brewery.

PREPARATION

1. Ensure you have the ingredients you need. A standard WilliamsWarn kit is shown in Figure 5 in the section "What you need". Ideally any thick liquid extract you use for beverages like beer or mead should be removed from cold storage in your refrigerator the night before. If not, you can sit the can of extract in hot water, to warm up ahead of adding the ingredients after this cleaning stage (remove the yeast from under the can lid before you do so).
2. Ensure you have the Sundry and Kitchen Equipment required, as shown in Figures 6 and 7 in the section "What you need".
3. Ensure the Personal Brewery is switched off (the power button is not lit up when the brewery is off). Ensure that the black 3-way valve on the control panel is closed (the X position).
4. Inspect the gas cylinder in the tower and ensure that there is pressure in the gas cylinder as measured by its high pressure gauge (see Figure 4C). If the cylinder is empty or not attached, attach a full gas cylinder as described in 'Setting up your Personal Brewery' in Part One.
5. Ensure the gas cylinder low pressure gauge (see Figure 4C) is set at the final dispense pressure you want, as discussed in Appendix 5. First time users should set this at 1.25 bar.

   Also check the brewery CO_2 line valve is closed at the back of the draft tap font.
6. Start boiling 500ml (1 US pint) of water in your kitchen kettle for use in Step 10.
7. Then remove all pressure from the vessel by pushing the button on the top of the variable pressure relief valve (VPRV) (see Figure 8). Release the button when the vessel pressure gauge on the control panel reads 0 and no gas is being emitted.

   Remove the vessel lid (it screws off counter-clockwise). If the sediment bottle is attached from the last brew then remove it (it comes off clockwise looking down on the bottle from above). Put the 2 Litre jug under the vessel valve and open the valve and dump any vessel residue into the jug (See Figure 9).

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Then close the vessel valve and dump the contents of the jug down the sink.

CLEAN THE VESSEL WITH WATER

8. Rinse the jug and fill it with 2 Litres of cold water. Close the vessel valve and dump the 2 Litres of water into the vessel cone (Figure 10). Dip the sponge into the water that is in the cone and give a preliminary scrub of all the internal surfaces of the vessel, including under the rim, the yeast ring (from any previous brew), the vessel wall and the cone (see Figure 11).
9. Put the jug under the vessel valve and open the valve to remove the dirty water from the vessel. Close the vessel valve and dump the contents of the jug down the sink and rinse the jug.

CLEAN THE SEDIMENT BOTTLE AND VESSEL LID WITH DETERGENT

10. Add 1 rounded teaspoon (5g/0.18oz) of WilliamsWarn Brewery Detergent powder to 1 Litre (2.1 US pints) of warm water (approx.60°C/140°F as discussed in Appendix 1, being half boiled water and half cold water or alternatively 1 Litre of water from a hot water system) in the 2 Litre jug (see Figure 12) and mix well with the spatula.
11. Rinse the sediment bottle well with water under the tap and then fill up the sediment bottle to the brim with the detergent solution (this will use about 950ml of the detergent in the jug, see Figure 13). Let the sediment bottle soak in warm detergent for a few minutes while you clean the internal surface of the lid.
12. Preferably with a protective glove on (although not essential), dip the sponge into the remaining 50ml of detergent in the jug and give the internal surface of the vessel lid a scrub with the detergent (see Figure 14). Rinse the lid under the tap when finished (see Figure 15).

CLEAN THE DRAFT TAP AND FILLING LINE WITH DETERGENT

13. Ensure the vessel valve is closed and then add all the detergent in the sediment bottle to the 2 Litre jug and then add the 2 Litre jug contents to the cone of the vessel (see Figure 16).
14. Rinse the sediment bottle well with water from your tap to remove the detergent residue.
15. Then close the vessel lid on the vessel (see Appendix 4 for important information on how to ensure a good vessel lid seal). Then open the 3-way valve partially towards the arrow pointing to the vessel pressure gauge and slowly add 0.3bar/5 psi pressure of CO_2 from your gas cylinder to the vessel (as read on the vessel pressure gauge on the control panel). Then return the 3-way valve to its closed (X) position.
16. Put the 2 Litre jug under the draft tap (See Figure 17) and take out 100ml of detergent by pushing the draft tap flow controller lever right down to its fully open position and then alternating between pulling and pushing the draft tap open every 2 seconds. Then close the draft tap.

Fig. 12

Fig. 13

Fig. 14

Fig. 15

17. Put the 2 Litre jug under the filling line valve and open the valve and allow 100ml to flow into the jug (see Figure 18) then close the valve.

    For those with the WilliamsWarn counter-pressure bottler, if you would like to clean your filling line tube and bottler, for this step you should attach the brewery filling line valve to the Bottler using the filling line tube. Once the line is connected, ensure the Bottler dispense valve is closed and then open the brewery filling line valve. Then put the 2 Litre jug under the open end of the Bottler filling tube, open the Bottler dispense valve, collect the 100ml into the jug (see Figure 19) and then close the bottler dispense valve. Leave the Bottler connected for the sanitation step.

    See WilliamsWarn Bottler Instructions for further information.

    Dump the 200ml of detergent in the jug down the sink.

    The draft beverage line and packaging valve/line will now soak with detergent while you manually clean the vessel.

CLEAN THE VESSEL WITH DETERGENT

18. Check the 3-way valve is in the closed (X) position and then remove all pressure from the vessel again by pushing the button on the variable pressure relief valve (VPRV) (see Figure 8). Release the button when the vessel pressure gauge on the control panel reads 0 and no gas is being emitted.

    Then remove the vessel lid (it screws off counter-clockwise).

19. Dip the sponge into the cleaning fluid in the cone and scrub all of the internal surfaces of the vessel, including around the rim, under the rim, the yeast ring (from any previous brew), the vessel wall and the cone. (See Figure 20).

20. When the vessel is clean, place the empty 2 Litre jug under the vessel, open the vessel valve and dump the contents of the cone into the jug (See Figure 21). Dump the contents of the jug down the drain and place the jug under the open vessel valve again.

RINSE THE VESSEL WITH WATER

21. Fill the 500ml rinse bottle with cold water and rinse the detergent residue off the vessel by spraying the water around and under the rim and evenly down the sides of the vessel from the top (See Figure 22). Ensure a good flow going down the walls to rinse off the detergent. Repeat this step twice more.

    The very top part of the vessel around the vessel seal can be wiped with a paper towel to avoid water running down the outside of the vessel.

    Close the vessel valve and dump the contents of the 2 Litre jug down the drain.

    The vessel should now be clean and the stainless steel shiny and spotless, ready for sanitation.

SANITISE THE VESSEL

22. Add 500ml of cold water to the 2 Litre jug then add ½ a rounded teaspoon (2.5g) of Sodium Percarbonate and mix well with the tablespoon until the solids are dissolved. Add this solution to the 500ml rinse bottle (see Figure 23).

Fig. 16

Fig. 17

Fig. 18

Fig. 19

Fig. 20

23. Ensure the vessel valve is closed and then spray the sanitising solution under the rim and evenly down the side walls so that all surfaces are wetted (See Figure 22 again). Try to wet all surface with this 500ml of sanitizer and let all the sanitising agent solution collect into the cone of the vessel (See Figure 24).

    If not all surface became wetted, collect the liquid back into the wash bottle (open the vessel valve and dump the liquid into the 2 Litre jug first) and repeat again.

24. With the sanitising solution in the cone, check the seal is sitting in its groove properly again like you did in Step 15 (see also Appendix 4) and then close the vessel lid onto the vessel again. Once more, open the 3-way valve partially towards the arrow pointing to the vessel pressure gauge and once again slowly add 0.3bar/5 psi pressure of CO_2 from your gas cylinder to the vessel, as read on the vessel pressure gauge. Then put the 3-way valve back to its closed (X) position.

SANITISE THE DRAFT TAP, FILLING LINE AND VESSEL LID.

25. Put the 2 Litre jug under the draft tap (See Figure 17) and take out 100ml of sanitising solution by pushing the draft tap flow control lever right down to its fully open position and then alternating every 2 seconds between pulling and pushing the draft tap open to sanitize both parts of the tap. Then close the draft tap. The first part of what you take out is the detergent you left soaking in the line in Step 17.

    NOTE: Every 10th brew or so it may be necessary to take the tap apart and clean it as described in Appendix 9. This will be necessary if you can see any growth of grime or a similar unwanted film at the front of the tap or if the tap becomes sticky when being pulled and doesn't easily return to the closed position.

26. Put the 2 Litre jug under the filling line valve and open the valve and allow another 100ml to flow into the jug (see Figure 18) then close the valve.

    Wait 1 minute for the line to soak.

    For those with the WilliamsWarn counter-pressure Bottlers, the Bottler will still be connected, so put the 2 Litre jug under the open end of the Bottler filling tube, open the Bottler dispense valve and close when the 100ml is collected (see Figure 19).

27. After the filler line has soaked for 1 minute, open the filling line valve again and collect the remaining solution in the vessel into the 2 Litre jug and only close the valve when CO_2 gas is being emitted out of this line. It is critical to be sure the valve is closed and holding the pressure and no gas is being emitted, so as to avoid beverage leaking out this valve during fermentation.

    For those with the WilliamsWarn counter-pressure bottling device, you will be opening the Bottler dispense valve (See Figure 19). Once CO_2 is emitted, close the Bottler dispense valve and the brewery filling line valve and for the same critical reason underlined above, ensure pressure is being held by the closed filling line valve.

28. Put the 2 Litre jug under the draft tap and open the tap to remove any remaining sanitising solution from that line too. Close the draft tap when CO_2 is being emitted. Again,

Fig. 21

Fig. 22

Fig. 23

Fig. 24

it is critical to be sure the draft tap is closed and holding the pressure and no gas is being emitted, so as to avoid beverage leaking out the draft tap during fermentation.

Keep the sanitizer in the jug, do not dump it down the drain.

29. Then push the draft tap flow control lever all the way up so to close this. This is important as it is an additional safety closure that will help ensure no beverage leaks out of the draft tap as the pressure rises during fermentation.
30. Check the 3-way valve is in the closed position and then remove all pressure from the vessel again by pushing the button on the variable pressure relief valve (VPRV) (see Figure 8). Release the button when the vessel pressure gauge on the control panel reads 0 and no gas is being emitted.

    Then remove the vessel lid (it screws off counter-clockwise).
31. Put the 2 Litre jug under the vessel valve, open the vessel valve and drain all remaining 300ml or so of sanitizer from the vessel. Close the vessel valve.
32. Take the approximately 500ml of sanitizer that is now in the jug and pour it into the sediment bottle. Put your hand over the end of the sediment bottle and shake the bottle for 1 minute to get all internal surfaces wetted with sanitizer (See Figure 25). If you prefer not to get sanitising agent on your hands use a glove or just swirl the sanitizer to wet all the surfaces.
33. Then pour the sanitizer from the sediment bottle into the upside vessel lid on a table so that the internal lid surface can also soak with sanitizer. Rinse the sediment bottle well with water to remove all sanitizer and put it on the table. Then swirl the upside-down lid gently so that the sanitizer can wet all surfaces and parts of the lid thread. Take the seal out of the vessel seal groove and place it in the sanitizer in the upside down lid. Let the lid and seal soak in the sanitizer (see Figure 26).
34. Put the empty jug under the vessel valve and open the vessel valve to remove any final residual sanitizer. Close the vessel valve and dump any residue in the jug down the drain and rinse the jug well to remove all sanitizer.
35. Let the upside-down lid and seal soak in sanitizer until required in the next stage involving adding the ingredients.

    If you are cleaning the brewery but not going to make another brew right now, then after the lid and seal have soaked for 1 minute, put the seal back in its grove on the vessel rim. Then dump the sanitizer from the upside down lid and put it back on the brewery. There is no need to rinse the lid.

THE BREWERY IS NOW CLEANED AND SANITISED AND READY FOR THE ADDITION OF INGREDIENTS.

You do not need to rinse the sanitizer off the vessel walls. As explained in Appendix 1, we are using a no-rinse sanitizer.

Fig. 25

Fig. 26

STAGE TWO:
ADD THE INGREDIENTS

Please read Appendix 2 first, for background information and principles regarding the adding of ingredients and Appendix 6 on how to set the temperature on the digital controller.

For ease of understanding we will refer to the liquid produced in this step that the yeast is added to as “wort/must”. Wort is the term used in beer and Must is the term used for cider, mead and wine. For your info, wort is pronounced “wert” not “wart”.

BOIL WATER

1. Start to boil 1.5 Litres (3.2 US Pints) of water in the kitchen kettle.

HYDRATE THE YEAST

2. While the kettle is boiling, add 250ml (8.5 US fl. oz.) of water, as read on the sediment bottle, at 25 +/- 5°C (77 +/- 9°F) to the cleaned sediment removal bottle. Use the thermometer to get the water temperature correct and use cold and warm water as required.

   NOTE: If you do not have a thermometer, you can add the yeast to an empty sediment bottle instead and the yeast will rehydrate in the wort/must in Step 12 when you attach the bottle and open the tank valve. However, wait until you are at that step before opening the yeast packet and adding it to the empty sediment bottle.

3. Open the yeast sachet with the scissors and add the yeast to this water (see Figure 27). Swirl the bottle for 10 seconds to help mix the yeast and then let it sit while the next steps are taken (See Figure 28).

ADD ANY LIQUID EXTRACTS

For thick Liquid Extracts like those used for beer and mead see 4A below. For thin extracts like those used for cider and wine see 4B below.

4. A) For thick extracts: Add 750ml (25 US fl. oz.) of the boiled water to the 2 Litre jug. Open the liquid extract with the can opener and add most of the extract to the water in the jug whilst stirring the water with the spatula (see Figure 29). Put the can with the residual extract on the table while you continue to dissolve all the extract well in the jug by stirring. Check the vessel valve is closed and then add this dissolved extract in the jug to the brewery (see Figure 30).

   Fill the empty extract can with the remaining boiled water (750ml/25 US fl oz.) and top the can up with cold water. Stir with the spatula to dissolve all remaining extract (see Figure 31) and then add this to the jug (use a cloth to hold the can if it is too hot to handle).

Fig. 27

Fig. 28

Stir the contents of the jug to help dissolve any remaining extract and then add this to the brewery also.

Then using the jug, add the first 2 Litres and then 1 Litre of cold tap water to the brewery (3 Litres Total) to provide more volume to dissolve any dry extracts into.

B) For thin extracts: Add the contents directly to the brewery (with the vessel valve closed). Rinse the package with cold water and add that to the brewery.

ADD ANY DRY EXTRACTS

5. Open the dry extract bag (or other dry products you may be using) with the scissors and add to the liquid in the brewery in one dump and then stir with the spatula (see Figure 32). Some lumps may form that are difficult to dissolve but they will dissolve by themselves as you fill the brewery with water and over the next hour or so after the vessel is closed.

   If you intend to measure the SG of your wort/must to be able to calculate the alcohol content of your final beverage, then you need to dissolve all the dry extract to get an accurate reading. This is better done by adding the dry extract in smaller amounts and stirring before adding the next amount.

ADD ANY OTHER INGREDIENTS

6. If you are adding more ingredients as described in Part 3: Making Beverages with the Advanced Method, you can add them now.

FILL UP TO THE 23 LITRE MARK

NOTE: Please read Appendix 2 regarding the need to add some hot water if your cold water source is below 12°C/54°F.

If you have used the 1.5L of boiled water already to dissolve liquid extract (e.g. making beer or mead) then follow 7A below. If you have not used the boiled water (e.g. making cider or wine, follow 7B.

7. A) Have used the 1.5L boiled water from Step 1 (e.g. making beer or mead): Fill up to the 23 Litre mark with your main cold water source. You can use the 2 Litre jug to take the water from the tap to the brewery (see Figure 33) or a large pot or even a hose depending on your set-up. The 23 Litre mark is a small round dimple on the back wall of the vessel near the top. As you get close to the mark, you may need to move foam from the wort/must surface using the spatula to see where the liquid level is (see Figure 34).

   Once at the 23 Litre mark, stir all the total contents in the brewery gently for about 10 seconds with the spatula , to get a homogenous liquid wort/must. It's good to try and get a vertical stir so that and denser liquid at the bottom comes to the top and mixes.

   B) Have NOT used the 1.5L boiled water from Step 1 (e.g. making cider or wine): Fill the tank half way with cold water, add the 1.5 Litres of hot boiled water from the kitchen kettle, then continue to top up with cold water and mix as described in 7A.

SG SAMPLE

8. Once full and if desired, you can take a 100ml sample for a hydrometer reading of the wort/must initial specific gravity

Fig. 29

Fig. 30

Fig. 31

(also known as original gravity (OG)). See Appendix 3: Taking S.G. samples & calculating alcohol %'s.

For Standard Kits supplied by WilliamsWarn, you do not need to take an initial sample as the beers will be SG 1.040 and the cider 1.036 (when using two cans).

CLOSE THE LID

9. If you have been soaking the vessel seal in sanitizer in the upside-down lid, take the seal and put it back in its groove on the vessel rim and then dump the sanitiser from the lid down the drain. If not, proceed to the next step.
10. Check the vessel seal is sitting properly in the groove of the vessel rim as discussed in Appendix 4 (it may need a slight stretch as shown in that appendix). Then close the lid tight. The lid must be closed tight to hold pressure during fermentation, so use good strength to get a good seal.

    Check the VPRV is wound right down to its fully closed position (clockwise).

    NOTE: Appendix 4 also discusses the option of applying some food grade silicon grease to the seal to help with sealing and also lid removal when the tank is empty.
11. For first-time users, we suggest testing the lid seal at this point by adding some pressure to the tank. It is preferable to perform this before the yeast is added. To do this, open the 3-way valve clockwise to the arrow pointing to the vessel pressure gauge, add 0.5 bar of pressure to the vessel and then close the 3-way valve. Wait 1 minute to check the pressure holds then release all the CO_2 from the vessel by pressing the release button on the VPRV until the vessel gauge reads 0 bar.

    If the pressure does not hold but drops, then release the pressure from the tank and re-set the seal in the rim and try the pressure test again (ensure the VPRV is fully closed also) so that the vessel holds pressure.

    Experienced brewers can skip this pressure test step once confident of obtaining a good lid seal each time.

ATTACH THE SEDIMENT BOTTLE AND THE YEAST

12. Swirl the yeast in the sediment bottle again and then firmly screw it onto vessel valve (it screws on anti-clockwise looking down on the bottle - see Figure 35). For those without thermometers you can add the dry yeast to the empty sediment bottle now and attach it to the vessel.

    IMPORTANT: The bottle should be screwed on so that it is solidly hand-tight to withstand the pressure during fermentation. If the bottle is not sealed tight there may be some leakage during fermentation.
13. Check there is no pressure in the vessel and then open the vessel valve slowly and gently let in 250ml of wort/must so that the total volume in the bottle is about 500ml (as read on the bottle scale) and then close the vessel valve (see Figure 36). Wait 1 minute so that the rehydrating yeast can acclimatise to the temperature of the wort/must without experiencing a large temperature differential too quickly (see Appendix 2 for more details).This technique also reduces osmotic stress on the yeast.

Fig. 32

Fig. 33

Fig. 34

Fig. 35

14. Then open the vessel valve again and let the wort/must gently fill the sediment bottle fully (see Figure 37). Once the bottle is full, leave the vessel valve fully open so the bottle contents mix with the vessel during fermentation.
15. Put the neoprene cover on the sediment bottle to insulate it from ambient temperatures (see Figure 38).

ENSURE THE VPRV IS SET

16. Set the VPRV to release at 1.5 bar/22psi by opening it 2 ½ turns counter-clockwise. This will enable you to carbonate to a level typical for the most common beverage types.

    However you will need to adjust this over the next few days once the pressure has built up. See Stage 3 and Appendix 5 for more details about the VPRV and carbonation.

SET THE DESIRED FERMENTATON TEMPERATURE

17. Please read Appendix 6 regarding how to set the digital controller. Then turn on the brewery and set the desired temperature for fermentation. We recommend 23°C/73°F for ales and 15°C/59°F for lagers. See Appendix 7 for more information on your temperature options.

    The temperature control system in the brewery will now bring the contents of the vessel to the fermentation temperature you have set, by either warming or cooling the vessel.

FINAL CHECK

18. Check the following:

    A) The 3-way valve is in the closed position (X)

    B) The VPRV is set correctly (approximately 2 ½ turns counter-clockwise from its fully screwed down position).

    C) The desired fermentation temperature is set (e.g. 23°C/73°F for ales and cider and 15°C/59°F for lagers).

    D) The sediment bottle is attached (and hand tight) and the vessel valve is fully open.

    E) The draft tap flow control lever is pushed all the way up to prevent any beverage leaking out the tap during fermentation.

    F) The brewery filling line valve and CO_2 line valve at the back of the draft tap font are both closed to prevent any beverage leaking out the taps during fermentation.

CLEAN UP

19. Discard all waste products in an environmentally friendly way and clean up.

Fig. 36

Fig. 37

Fig. 38

STAGE THREE:
MONITOR THE PRESSURE DURING FERMENTATION

Please read Appendix 5 first, for background information and principles regarding carbonation and monitoring the pressure.

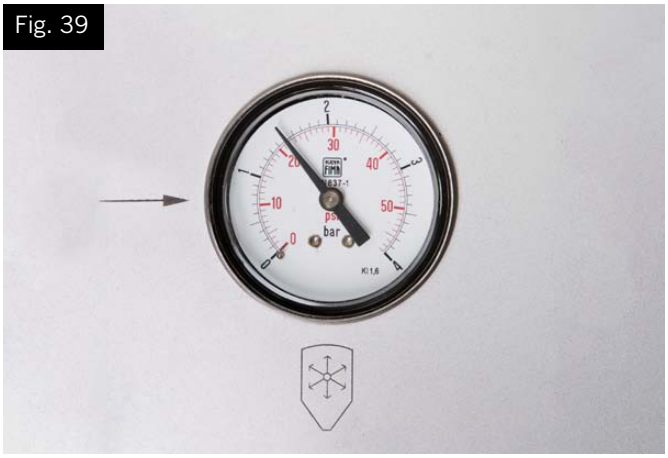
WHAT TO CHECK

After approximately 1 day for ales and a bit longer for lagers (depending on temperature), there should be many bubbles rising as seen in the sediment bottle and foam on the wort/must surface (as seen through lid sight-glass with the light on). The pressure in the vessel should have built-up to the pressure release point of the VPRV (Variable Pressure Relief Valve) that you set in Stage 2.

When the pressure in the vessel reaches this level, as read on vessel pressure gauge, the VPRV should release gas. The beverage is fully carbonated at this point and excess gas you don't need, will be emitted out of the valve.

1. Ensure the VPRV setting is correct by checking that gas is being emitted (heard as a slight hissing and smelt as a slight aroma) only at the target pressure or just above it (e.g. within 0.1 bar above target (see Figure 39)).

Fig. 39



WHAT TO DO

2. A) If the vessel pressure gauge shows a pressure too far above your target fermentation pressure (e.g. >0.1 bar above it as read on the vessel pressure gauge), you need to adjust the VPRV very slightly counter-clockwise (as described in Appendix 5) to release the gas to your target or within 0.1 bar above it (so first time users control at 1.5-1.6 bar).

   B) If gas is being emitted out of the VPRV below your target fermentation pressure (as read on vessel pressure gauge) the VPRV needs to be adjusted slightly clockwise (as described in Appendix 5) to release at your target or within 0.1 bar above it (so first time users control at 1.5-1.6 bar. You will need to wait for the pressure to build up to the new setting and release to be certain of your new setting. If you have no time to wait, you can manually add gas pressure from the gas cylinder to the vessel as described in Appendix 5 and set the VPRV to release at the target.

3. Once the VPRV is confirmed to be releasing gas at or just above the set point, it shouldn't need more attention. When fermentation is complete, the pressure will still be maintained in the vessel (and the beverage remains fully carbonated). We are fermenting at a slight excess pressure so you only need to be close to the target and not 100% accurate.

WHAT IF THERE IS NO PRESSURE BUILD UP AFTER 1 DAY?

If the pressure does not build up and the yeast is actively fermenting as seen in the sediment bottle, you likely have a leaky seal in the rim/lid or VPRM. See the Trouble Shooting Section, Problem 2 for a solution.

WHAT YOU WILL SEE IN THE SEDIMENT BOTTLE

Figure 40 shows what you will see in the sediment bottle for Nottingham Ale yeast over the first 4 ½ days for an ale fermentation. The yeast cells will start to become active after a few hours and begin to ferment. They will then disperse into the vessel due to their own CO_2 production and consume the sugars and other nutrient in the wort/must and multiply. When the sugars are depleted most yeast will settle in a similar manner as shown in Figure 40.

Each yeast behaves differently so the amount of settling of the yeast and the clarity of the beverage above the settled yeast will vary.

WHAT TO EXPECT FROM OTHER YEAST

S-33

S-33 ale yeast does not settle as well as Nottingham Ale yeast. By Day 4, before you put the cooling on, there will likely be $^1/_3$ of the sediment bottle with settled yeast but the rest of the bottle quite cloudy with unsettled yeast. See Figure 40A. Cooling the beverage will settle the yeast a little, but in general the top half of the bottle will be quite cloudy when you remove it in Stage 5.

W34/70 and S-23

Lager yeast like W34/70 and S-23 used in our lagers and pilsners, will settle quite well after fermentation, as shown in Figure 40B.

So by Day 6 there will be quite a well defined boundary between the yeast and the beverage above, before you put the cooling on.

T-58

For a 4-5% alcohol ale, T-58 Belgian Ale yeast will ferment out in 4 days and then sediment as shown in Figure 40C. There will be a definitive line between the yeast and beer but the beer above the yeast line will be quite cloudy still with unsettled yeast.

Fig. 40

Fig. 40A

Fig. 40B

Fig. 40C

STAGE FOUR:
COOL THE BEVERAGE

Please read Appendix 6 regarding how to set the digital controller and Appendix 7 for background information on typical fermentations and principles regarding when to cool the beverage and the effects of cooling the beverage.

In general cooling can be put on at Day 4 for ales and Day 6 for lagers and ciders. However you should check fermentation is finished before putting on the cooling. As discussed in Appendix 7 this can be checked by measuring the Specific Gravity (SG) and/or checking there is no major activity in the sediment bottle, meaning there are no longer bubbles of CO_2 rising constantly.

WHAT TO DO

1. When the beverage is fully fermented or fermented to the SG you desire, set your desired dispense temperature on the digital controller (see Figure 41).

   The temperature control system will control the temperature of the vessel to the new set-point.

   We suggest first time users cool to 2°C/36°F unless you like warmer beverages, in which case you can set it a few degrees higher.

   Please be aware that the beverage will actually warm-up a few degrees as it passes through the draft beverage line, draft tap, and into your glass. So the final temperature as you consume the beverage will be a little higher than what you actually set here.

   For more information regarding beer styles and optimal beer temperatures, See Appendix 5, Table 2.

Fig. 41

STAGE FIVE:
CLARIFY THE BEVERAGE

Please read Appendix 8 for background information and principles regarding clarifying the beverage.

FIRST CLARIFICATION

First clarification can take place 12 hours after cooling has started, so in general, Day 4 ½ for ales and Day 6 ½ for lagers and ciders.

The pressure in the vessel may have dropped slightly due to the effect that cooling the beverage has on the dissolved carbon dioxide. Colder temperatures allow more carbon dioxide to dissolve in a beverage and the pressure reduces a little because of that.

So for first-time users who fermented at 1.5 bar, you may see the pressure on the vessel pressure gauge reading between 1.25 and 1.5 bar.

1. Screw the VPRV right down (clockwise) to its fully closed position. It has done its job and naturally carbonated the beverage for you. It will now act as a safety relief valve if someone inadvertently adds too much pressure from the gas cylinder. However we will use the button on top of the VPRV in the next steps to release gas manually.
2. Open the tower door and check that there is gas pressure from the gas cylinder on the high pressure gauge. If not, attach a full gas cylinder, as described in 'Setting up your Personal Brewery' in Part One. Check the gas cylinder low pressure is set at the final dispense pressure you want. First time users should set this at 1.25 bar as discussed in Appendices 5 and 7.
3. Close the vessel valve. Unscrew the sediment bottle (see Figure 42). It screws off clockwise looking down on the bottle. It is under pressure so there will be a small release of pressure as it is unscrewed but it is full of liquid, so it will be minimal. However it is advisable to unscrew the bottle with one of your hands wrapped around the top part of the bottle, to block any small spraying of beverage.
4. When you have unscrewed the bottle, place it in the stainless steel bowl under the tank (see Figure 43). Then take the 500ml spray bottle and spray up into the vessel valve to remove beverage residue from the under-side of the valve and valve thread (see Figure 44). Let the water drip onto the bowl. Then using the removable stainless steel bowl under the vessel to prevent dripping onto the floor, take the sediment bottle and bowl to a sink (Figure 45) and dump the sediment down the drain and rinse the sediment bottle and stainless bowl both well with water.
5. Then put the bowl back under the tank and take the well rinsed sediment bottle to the draft tap. Put the bottle under

Fig. 42

Fig. 43

Fig. 44

Fig. 45

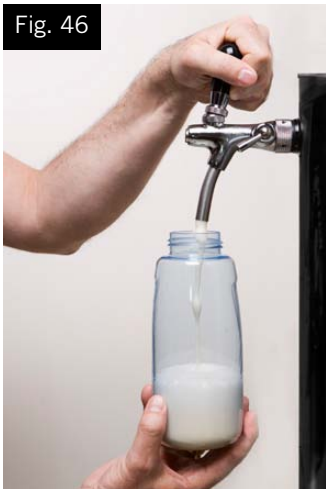


Fig. 46

the tap and push the draft tap flow control lever all the way down to its fully opened position (see its open position in Figure 46). Then push the draft tap towards the back of the brewery to create foam to come out of the tap (this is the foam mechanism part of the tap). Fill the sediment bottle with foam by allowing the foam to fall to the middle of the bottom of the sediment bottle and not roll down the side (See Figure 46).

Foam consists of bubbles of CO_2 that have a positive pressure. As we fill the sediment bottle this way, the foam and its bubbles of CO_2 will displace air in the bottle. The top surface of the foam will retain the positive pressure and not take in air and as the bottle is filled, we can displace all air from the bottle.

Fill the sediment bottle to the very top with foam then close the draft tap and push the draft tap control lever up to its fully closed position (see Figure 47).

6. Put the sediment bottle (which is now full of foam) back on the vessel and close it hand-tight as per normal. The bottle screws on anti-clockwise looking down. Once the bottle is securely attached, open the vessel valve slowly and let beverage fill the sediment bottle. Check you have put it on tight enough and it is not leaking. Once full, leave the vessel valve fully open so that the sediment bottle is open to the vessel again, but now has only beverage in it, not yeast and beverage (see Figure 48).

7. Ensure the 3-way valve is closed (X position) and open the clarification pot. Add 30ml of WilliamsWarn clarification agent to the 100ml cylinder and then transfer that to the pot (see Figure 49). Then screw the lid back onto the clarification pot tightly.

   NOTE: The next sequence of forcing clarification agent into the beverage is required for first time brewers to use, in order to create an exact and known pressure differential and then experience the amount of "vigorous bubbling" of clarification agent that is required to mix the agent well. There is an alternative method described for in Appendix 9 that experienced brewers may like to try after a few brews, which focuses on the amount of bubbling heard without knowing the exact pressure differential created.

8. Lower the vessel pressure (as read on the vessel pressure gauge on the control panel) to 0.50 below your gas cylinder low pressure set point (that you checked in step 2 above in this Stage) by pushing the button on top of the VPRV. For first time user who have set the CO_2 cylinder low pressure at 1.25 bar, this will mean releasing the pressure in the vessel from just under the pressure achieved during fermentation (e.g. 1.5 bar or under as the cooling of the beverage reduces the pressure a little bit) to 0.75 bar, as read on the vessel pressure gauge on the control panel.

9. You are now going to force the clarification agent into the vessel. It is critical to be able to hear the clarification process in order to be sure it has occurred, so turn off all external noise like any music players, the radio etc.

   Open the black 3-way valve to the pot for 10 seconds only, by turning the 3-way valve anti-clockwise from its closed (X) position to be in-line with the arrow pointing to the clarification pot (see Figure 50). Allow the clarification agent to bubble and mix into the vessel for 10 seconds. The bubbling sound should be audible and must be vigorous

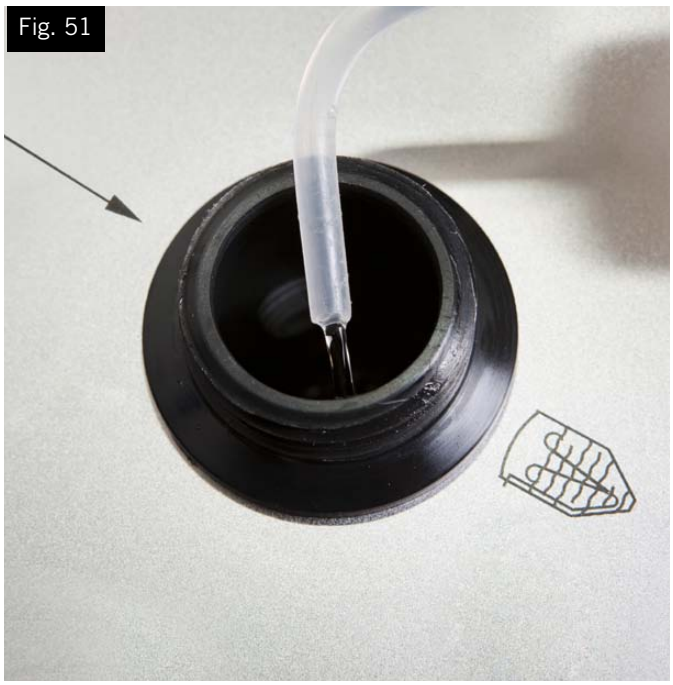
Fig. 47

Fig. 48

Fig. 49

Fig. 50

Fig. 51



enough to imply a good mixing of the clarification agent with the beverage. The mixing can also be seen through the vessel lid sight-glass with the help of the vessel light.

10. After 10 seconds of bubbling, close the 3-way valve (X position). If clarification is done properly, the pressure of the vessel should increase by about 0.25 bar or slightly more. So for first time users, the pressure in the vessel should be about 1 bar or just above it.
11. You now need to rinse the clarification pot. Open the pot lid and use the 500ml wash bottle to rinse water down the sides of the pot wall (see Figure 51). Fill to the level that the CO_2 line enters the pot and then close the lid on the pot again.
12. The pressure on the vessel should still be lower than the gas cylinder pressure, so turn the 3-way valve back to the arrow pointing to the clarification pot and bubble the rinse water through the lines and into the vessel for a few seconds. Mixing is not required as this step is just to rinse the clarification pot and its lines of any clarification agent.

    If you do not hear the water bubble into the vessel, you may have increased the pressure in the vessel too much during step 8 by bubbling too long. You may then need to release some pressure from the tank again as you did in step 7, to create a pressure differential and then repeat step 12.
13. Then turn the 3-way valve clockwise to the arrow pointing to the tank pressure gauge so that the gas cylinder pressure (1.25 bar for first time users) will now hold pressure in the tank at your set point for beverage dispense.

    Yeast and haze protein will now have reacted with the clarification agent and you will be able to see some particles falling into the sediment bottle.

    After 24 hours the sediment bottle should be about ½ full of sediment or more (see Figure 52), depending on the yeast and beverage type.

SECOND CLARIFICATION

A second clarification can take place 24 hours after the first clarifications so in general, Day 5½ for ales and Day 7½ for lagers and ciders.

14. Close the vessel valve (to avoid disturbing the settled yeast) and close the 3-way valve (X position). Then perform another clarification as described above from steps 7 – 13 with 20ml of clarifying agent. Ensure the last step (step 13) of turning the 3-way valve to the tank is performed so that the beverage can equilibrate with the CO_2 cylinder pressure.
15. Then open the vessel valve to allow a second lot of new sediment to settle over another 24 hour period at least, but 36 hours in general.

    After this 36 hour period the sediment bottle should be about ¾ full of sediment (see Figure 53) depending on the yeast and beverage type and there should be some clear beverage above that.

    As explained in Appendix 8, some yeast are harder to clarify than other yeast and as you brew more you will gain more experience in this aspect of brewing.

Fig. 52

Fig. 53

STAGE SIX: DISPENSE THE BEVERAGE

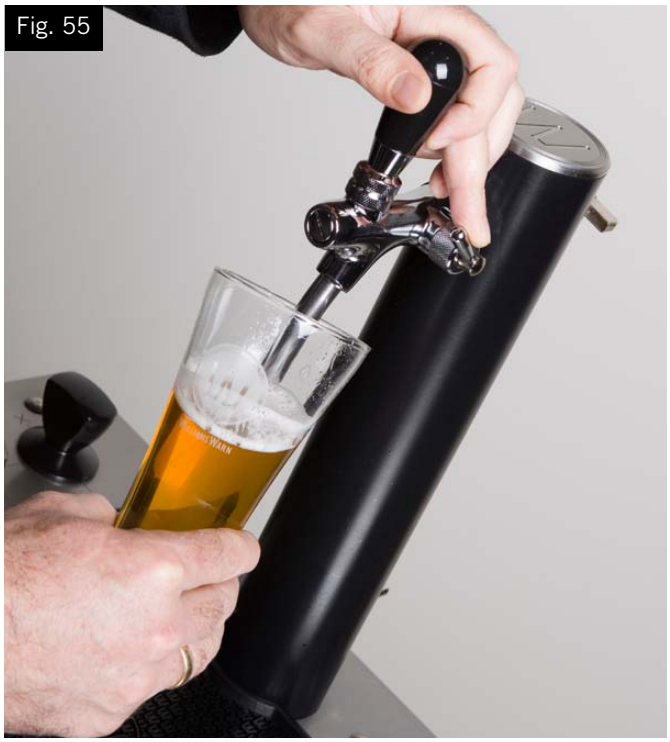
Please read Appendix 9 for background information and principles regarding dispensing the beverage.

Dispense can take place 24 hours after the second clarifications but for extra clarity we recommend waiting 1 ½ days. So in general, you should be enjoying the beverage at Day 7 for ales and Day 9 for lagers and ciders.

1. The bottle should be ½ to ¾ full of clarified sediment with a clear beverage layer seen at the top of the bottle (See Figure 54).
2. Close the vessel valve. Unscrew the sediment bottle (see Figure 42). It screws off clockwise looking down on the bottle. It is under pressure so there will be a small release of pressure as it is unscrewed but it is full of liquid, so it will be minimal. However it is advisable to unscrew the bottle with one of your hands wrapped around the top part of the bottle, to block any small spraying of beverage.
3. When you have unscrewed the bottle, place it in the stainless steel bowl under the tank (see Figure 43). Then take the 500ml spray bottle and spray up into the vessel valve to remove beverage residue from the under-side of the valve and valve thread (see Figure 44). Let the water drip onto the bowl. Then using the removable stainless steel bowl under the vessel to prevent dripping onto the floor, take the sediment bottle and bowl to a sink (Figure 45) and dump the sediment down the drain and rinse the sediment bottle and stainless bowl both well with water.
4. Then put the bowl back under the tank.
5. For safety reasons, we recommend putting the rinsed and empty sediment bottle back onto the brewery but do not open the vessel valve! It can stay there, empty under the closed valve, as a safety device should someone or some child accidently open the vessel valve.
6. To pour your first beverage, hold a glass under the draft tap and close the draft tap flow control lever by pulling it up as far as it goes. Then pull the tap towards you and then

Fig. 54

Fig. 55



with one of your fingers, open the flow controller slowly by pushing it down, to get an optimal flow (see Figure 55).

If it is the first pour of the day the first 50ml in the line may be warm and promote a little excess foaming in the glass, so a slow flow is optimal for the first part of the pour until the cold beverage exits the tap. Then you can adjust the flow controller to increase the flow speed and pour a good glass of your own making (see Figure 56).

When pouring beer, before the glass is full, push the tap away from you to create some beer foam onto the top of the glass.

If the beverage is not totally crystal clear don't worry, it will keep clearing and in most cases soon be bright. It just may just need an extra ½ day or so.

However some yeast need an extra clarification as discussed in Appendix 8.

7. Rinse the draft tap with water from the plastic wash bottle when you have finished pouring (see Figure 57). This will help stop bacteria growing inside the tap on any beverage and we recommend to do this after each pouring session.

   Now all that's left is to sit back relax and enjoy your beverage.

   See Appendix 9 for instructions when the vessel is empty.

Fig. 56

Fig. 57

Cheers!

Ian Williams Anders Warn

SHORT INSTRUCTIONS

After some time, these short instructions below are all you will need to help you brew. However, until the process becomes intuitive, the Standard Instructions in the previous section will be necessary. So start with the Standard Instructions and then use this one page when you feel more experienced.

For first time users, these short instructions also serve as an overview of the process.

STAGE 1: CLEAN AND SANITISE THE BREWERY (APPROXIMATELY 20 MINUTES)

1. Preparation
2. Clean the vessel with water
3. Clean the sediment bottle and vessel lid with detergent
4. Clean the draft tap and filling line with detergent
5. Clean the vessel with detergent
6. Rinse the vessel with water
7. Sanitise the vessel
8. Sanitise the draft tap, filling line and vessel lid.

STAGE 2: ADD THE INGREDIENTS (APPROXIMATELY 20 MINUTES)

1. Boil water in kitchen kettle
2. Hydrate the yeast
3. Add any liquid extracts
4. Add any dry extracts
5. Add any other ingredients
6. Fill up to the 23 Litre mark
7. Attach the sediment bottle and the yeast
8. Close the lid
9. Ensure the VPRV is set
10. Set the desired fermentation temperature
11. Final check
12. Clean up

STAGE 3: MONITOR THE PRESSURE DURING FERMENTATION (A FEW MINUTES).

STAGE 4: COOL THE BEVERAGE (A FEW SECONDS).

STAGE 5: CLARIFY THE BEVERAGE (2 X 5 MINUTES).

STAGE 6: DISPENSE THE BEVERAGE.

PART THREE: MAKING BEVERAGES WITH THE ADVANCED METHOD

INTRODUCTION

There is much flexibility for brewing many different beverage in your WilliamsWarn. After you have tried some or all of the Standard Ingredient Kits you may like to add a little extra flavour. You can do this quite easily using what we call our Advanced Methods.

Basically the Advanced Methods consists of adding extra ingredients that dissolve in the wort/must or adding extra water that has been steeped in the ingredients and then filtered before adding, to avoid particles blocking the draft tap.

The easiest Advanced technique is to soak hop pellets in a French coffee press as described in the following pages. This gives extra hops aroma and flavour to a standard kit.

Another technique is to boil hops for a while to add extra bitterness.

And the other main technique is to steep crushed specialty grains and strain them to add extra malt flavours.

A final technique is to add any flavour you want via any method you want, as long as you don't add particles to the wort/must that will block the draft tap and as long as the temperature of the wort/must when made up to 23 Litres (6 US gallons) is near 25°C (77°F) when the yeast is added.

Recipes for adding extra hops and malt and other ingredients will be added to our website in 2013 under the title Advanced Recipes. They will require these techniques to be used to add the extra flavours. As this will always evolve we are not placing the actual recipes in this User Manual.

But as long as you follow the techniques described in the next few pages, you can make other recipes on the BJCP Style Guidelines (see Appendix 10) from our Standard Kits to match our Advanced Recipe suggestions as well as any recipes you can find on the internet or in brewing books. This method we're employing is known as "Extract plus Grains" in the USA so any recipe you can find under that title will work.

Adding a little extra steeped hops and malt "tea" is how Santiago Aon Ratto won the Gold Medal for his Pilsner at the Asia Beer Awards in 2012, so it's definitely something to move into as you get more brews under your belt.

Good luck and don't be afraid to experiment.

ADDING EXTRA HOP FLAVOUR AND BITTERNESS

Hops can add bitterness, flavour and aroma to any brew. All beers needs some bitterness to balance the intrinsic maltiness of beer, but flavour and aroma are optional and dependent on the beer style being produced.

To bitter beer, hops need to be boiled at 100°C (212°F) for a period of time (e.g. 30 minutes to 1 hour). When you make beer from malt extract, this bitterness aspect is taken care of in the Liquid Malt Extract. All the bitterness for the style is already contained in the liquid extract. The dry malt extract contains no hops and only adds malt sugars, flavours and nutrients.

Hop aroma is derived from essential oils in the hops and you do not need to boil the hops to extract this. In fact, the opposite is true; when you boil hops you lose a lot of aroma in the steam emitted during boiling. For this reason brewers add hops at three points to get hop aroma in to a beer:

A. The last few minutes of a wort kettle boil

B. In the whirlpool (which is the step after boiling - the wort is hot but not boiling)

C. In the fermenter or maturation vessel ('dry hopping')

For WilliamsWarn brewers, a good option is mimicking the whirlpool addition and this is described below.

ADDING HOP AROMA

A very easy way to add hop aroma to any brew is to mimic the whirlpool hop addition in a brewery using what is known as a French coffee press (or Bodem or coffee plunger or other name, depending on where you live).

Purchase hops that are known for a good aroma. These are usually known as 'aroma hops'. Examples include Motueka, Riwaka, Hallertau, Amarillo, Cascade, Crystal, Centennial, Fuggles, Horizon, East Kent Goldings, Liberty, Mt Hodd, Nugget, Perle, Saaz, Tettnang and Willamette.

Before you start cleaning the brewery, take 50g (1.8oz) of aroma hops and add to the coffee press. Add 80°C/176°F water. Stir and let sit a while as you work. Stir a few times as you progress the cleaning and then let it settle. When you add the other ingredients during Stage 2, plunger the coffee press as shown in Figure 59. Be careful not to force too much pressure on the solids at the bottom in case you break your coffee press!

Then pour the green hop water into the brewery as shown in Figure 60. You need to avoid adding solids as hops solids can block the beer outlet pipe.

Fig. 59

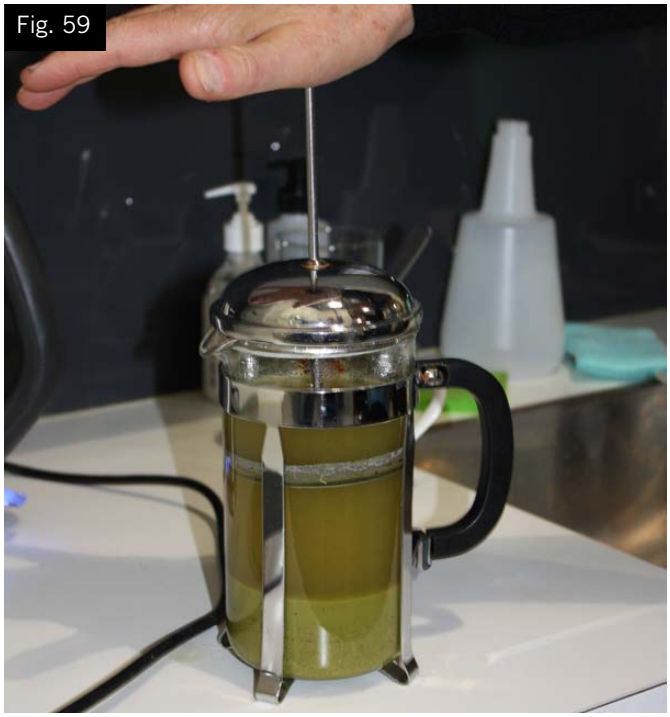


Fig. 60

Then add a dose of cold water to the coffee press to rinse the hops further, stir the hops again to extract more flavour compounds, plunger again and add another lot of green water to the WilliamsWarn.

You can also try leaving the hops in the bodem for a few days in a fridge to maximise extraction before pressing and adding.

You can, of course, use less or more than 50g (1.8oz). You can also try combining different hop varieties together. But please be aware that after the brewery has been filled to the 23 Litre mark with cold water, we want a wort temperature of about 25°C (77°F) for the yeast. So do not add too much hot water via the hop tea. If you want to soak an extreme amount of hops, it would be preferable to use water near 25°C (77°F). This green hop tea is full of hop flavours and aromas and will add complexity to any brew.

ADDING HOP BITTERNESS

To add extra hop bitterness, you need to boil hops.
For WilliamsWarn brewers, the easiest way is to boil some hops in 1L of water and then transfer that to a French coffee press to plunger it and filter it before adding to the brewery (as described in the aroma hop section above and shown in Figure 59).

The amount of extra bitterness you add depends on 2 aspects:

A. The amount of alpha-acids in the hops

B. How long you boil for

All hops have an alpha-acid level that is measured and stated on the hop packet. These get converted into iso-alpha acids when boiled and these are the bitter compounds in beer. The longer you boil, the more bitterness you make.

'Bittering hops' usually have a high alpha-acid content (e.g. 10-15%) and aroma hops usually a low amount (e.g. 4-10%). However you can use any hop to add bitterness.

The bitterness level ranges for most beers range from around 10 for American and Asian lagers to 70 BU's for IPA's and Stouts. Guidelines are given by the BJCP at this link http://www.bjcp.org/stylecenter.php

If you want to increase hop bitterness levels for your own personal preference, you can use several web-based tools. For example,

http://www.hotv.org/tools/hopbitterness.html
http://www.realbeer.com/hops/IBU.html
http://www.brewersfriend.com/ibu-calculator/

You will be asked to insert

Final wort or beer volume: 23 Litres (5 Imp Gallons, 6 US Gallons)
Wort specific gravity: 1.000 (we are boiling in water)
The alpha acid content for each hop used (read the packet - from 4%-16%)
The amount added (1 oz is 28g)
The time boiled (1-60 minutes)
Note: "Hop Utilisation" should be calculated for you.

Alternatively, you can use the chart below to discern how long to boil your hops for.

Example 1

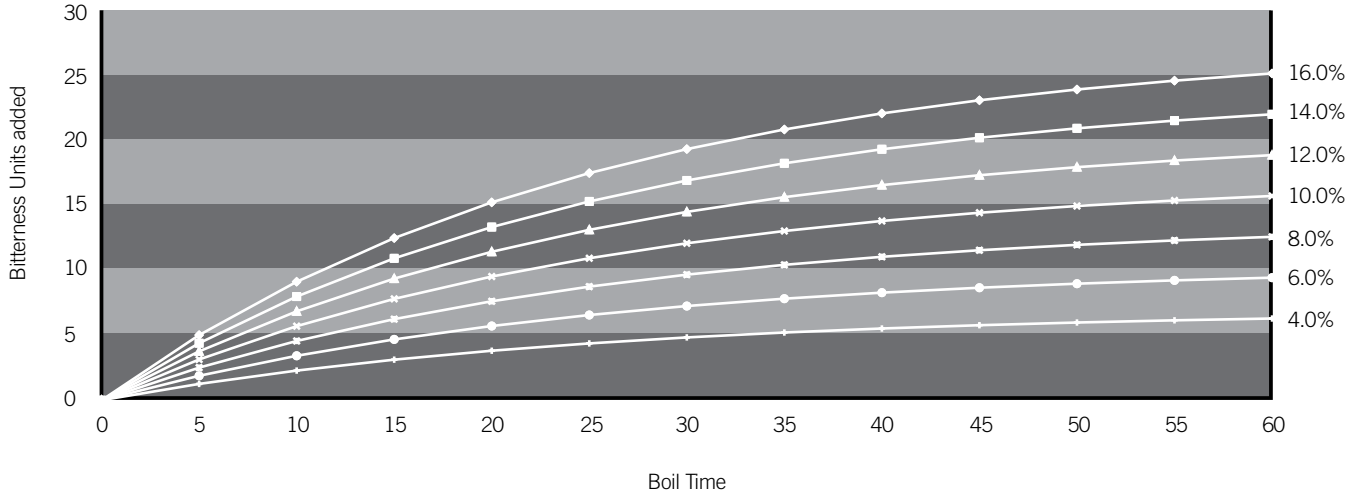
For every 10g of a 10% alpha-acid hops boiled for 30 minutes in 1 Litre of water (which is then filtered in a French Press and added to the WilliamsWarn with the other ingredients in Stage 2), 12 bitterness units will be added to the final beer.

Example 2

For every 10g of a 14% alpha-acid hops boiled for 60 minutes in 1 Litre of water (which is then filtered in a French Press and added to the WilliamsWarn with the other ingredients in Stage 2), 22 bitterness units will be added to the final beer.

BITTERNESS UNITS ADDED PER 10 GRAMS (0.35OZ) OF HOPS OF DIFFERING ALPHA ACID %

(WHEN BOILED IN 1 LITRE OF WATER AND ADDED TO 23 LITRES OF WORT)



ADDING EXTRA MALT FLAVOURS

BACKGROUND

Along with hops, there are certain types of grains that can also be steeped in hot water, with the resulting strained water being added to the brew to add certain characteristics.

When used with extract as a base, steeping specialty grains is a great way to make different beers styles and add colour, flavour, body, head-retention and mouth-feel to a brew.

This method, known in the US as "Extract plus grains", offers a lot of flexibility without the need to go through the 6-8 hour process of mashing grains, lautering, boiling, whirlpooling and cooling.

It only requires 30 minutes and a few extra bits of equipment.

IMPORTANT PRINCIPLES

We have a suggested method below, but as we've stated several times in this manual, there are many ways to make a brew.

So it's important you understand some important principles if you choose to adopt your own method. These are:

1. We are using hot water when we steep so we need to be careful that the wort is not too hot when we pitch the yeast. With this method we are using a different method to the Standard Method, but the volumes and temperatures are calculated with the same principle so that the final wort produced will be close to 25°C/77°F to reduce any temperature shock on the yeast when it is pitched.
2. A standard water to grain ratio used is not more than 1 US gallon to 1 pound of grains. This is 3.8 Litres per 455g of grain or 1 litre per 120g. This ratio is suggested to ensure a decent extraction of colours and flavours but to avoid too much extraction of tannins from the grain husks. Tannins can give a drying, puckering mouth-feel.
3. We suggest to heat the steeping water to 80°C/176°F and then add the grains. The temperature will then drop 5-10°C when the grains are added. Steeping above 80°C/176°F may result in excess tannin extraction and steeping above 70°C/158°F will ensure a pasteurisation of the grain material to reduce risk of infection so we're targeting mid-to-low 70°C's at the start of steeping.
4. If the amount of grain used is only 115g or less (1/4 lb), then we suggest to use a French Coffee Press with about 1 litres (2 US pints) of 80°C/176°F water added as shown for aroma hops in the previous chapter. Then use the Standard Method for ingredient addition rather than the method described below. It will not have too much effect on the final wort temperature and is simpler.
5. The grain must be crushed to extract the flavours and colours and other components. Each grain should be crushed into at least 5 parts to optimise extraction. Suppliers can crush grain for you or you can set up your own small mill or a similar system.
6. As long as the grains are strained from the water so no solids are added to the WilliamsWarn, which can block the beer tap, any soaking and straining method will work.

BASE MALTS VS SPECIALTY MALTS

To make wort or the extract (concentrated wort) used in the WilliamsWarn cans, grains commonly called Base Malts must go through a 6-8 hour process known as the brewhouse. This involves crushing, mashing, lautering, boiling, whirlpooling and cooling before adding yeast to the wort in a fermenter.

This provides the sugars and proteins the yeast needs to make beer. In the case of extract, the wort is evaporated into extract form and put into cans.

Along with the Base Malts, Specialty Malts can be added to add colour, flavour, body and head retention and some sugars and proteins.

Malt extracts like those supplied by WilliamsWarn have both Base and Specialty Malts in them. For example, our Dry Stout has a small amount of Roasted Barley to give the black colour and typical stout flavours.

However, Specialty Malts have the added bonus that they don't need to be mashed to give extra complexity to beer. You can steep them like when making a tea with a tea-bag and add the resulting strained water to a brew. In the water will be an assortment of flavours and colours and other compounds.

This steeping takes 30 minutes rather than 6-8 hours so is the perfect way to make all sorts of beers while still using WilliamsWarn or other extracts as the base malts.

EXAMPLES OF SPECIALTY GRAINS THAT MAY BE STEEPED

ROASTED MALTS	KILNED AND ROASTED MALTS
Carapils/Carafoam/ Dextrine Malt 3°L	Pale Chocolate Malt 200°L
Honey Malt 18°L/25°L	Light Roasted Barley 300°L
Crystal/Caramel Malt 10°L	Chocolate Malts 350-475°L
Crystal/Caramel Malt 20°L	Carafa Special II 430°L
Crystal/Caramel Malt 30°L	Black Barley 500°L
Crystal/Caramel Malt 40°L	Black Patent 525°L
Crystal/Caramel Malt 50°L	Black Malt 600°L
Crystal/Caramel Malt 60°L	Roasted Barleys 450-575°L

ROASTED MALTS CONT.
Crystal/Caramel Malt 80°L
Crystal/Caramel Malt 120°L
Special B 120-150°L
Meussdoerffer Rost 200°L

Base Malts that must be mashed include: Lager/Pilsner malt 2°L, Pale Ale malt 3°L, Wheat malt 3°L, Rye malt 3°L.

Some Kilned Malts that are kilned hotter than Base Malts and generally also need mashing but have been used in recipes as steeped malt include: Vienna malt 4°L, Munich malt 10°L, Aromatic malt 20°L, Amber malts e.g. (Biscuit malt 25°L, Victory malt 28°L), Melanoidin malt 28°L, Special Roast 50°L, Brown malt 70°L, and smoked malts.

The negative impact on steeping base malts is that you extract unconverted starch rather than sugars which can add to beer haze and infection risk (bacteria that eat starch).

Specialty malts like Crystal/Caramel malts have had the mashing process occur inside the grain during processing so the starch is already mostly converted.

OUR SUGGESTED METHODS

Under 115g/ ¼ lb malt

Add the crushed grains to a French coffee press and fill with 1 litre (2 U.S. pints) of 80°C/176°F. Steep for 30 minutes then plunger and add with other ingredients as per the Standard Method.

Over 115g/ ¼ lb malt

1. Heat 3.8 litres (1 US gallon) of water to 80°C/176° in a pot.
2. Add the grain in a muslin or nylon bag as shown in Figure 61.
3. Dunk the grain bag and swirl it around to get all the grains wetted and leave to soak for 30 minutes.
4. After 30 minutes remove the bag and let it drain. Do not squeeze the bag as that can add excess tannins from the husks. The temperature will be about 60°C/120°F and the remaining liquid will be about 3 litres (3/4 gallon) depending on how much grain you are using.
5. Now add your Liquid Malt extract to the pot and stir it in to dissolve.
6. Add some of the liquid in the pot back into the empty can and then stir the can to dissolve any remaining extract in the can and add this back into the pot.
7. Add this to the WilliamsWarn and then add the DME to this as described in the Standard Method.
8. Add any other ingredients and then top up to the 23L mark as described in the Standard Method.

Using this method, the final wort temperature in the WilliamsWarn before pitching the yeast should be similar to that described in the first table in Appendix 2. For example, for a 20°C/68°F water source the wort should be about 25°C/77°F and ready for the yeast to be pitched.

Fig. 61

As long as you rehydrate the yeast at about 25°C/77°F and add the water to the sediment bottle in 2 parts as described in the Standard Method, any temperature shock should be avoided even if your wort is closer to 17°C/63°F.

As described in the Appendix 2, if your cold water temperature is between 7-12°C (45-54°F), add 1 Litre (2 US pints) of boiling water before reaching the 23 Litre mark, in order to bring the final wort/must temp to about 20°C (68°F).

If your local water is below 7°C (45°F), add 2 Litres of boiling water before reaching the 23 Litre mark, to bring your wort/must temperature to about 20°C (68°F).

If your local water temperature is higher than 35°C (95°F), you will need to cool the wort/must to 25°C before adding the yeast to it, by setting the temperature controller to 25°C (77°F).

ALTERNATIVES TO A GRAIN BAG

As long as the grain is strained to avoid solids getting into the wort, you can use any system to extract the colour and flavour.

For example, the grains can be stirred and soaked in water and then the grains/water strained through a funnel with a strainer or a good colander to achieve the same effect.

THE EFFECT ON SG AND ALCOHOL

Soaking specialty grains will also add some small amounts of sugars to the wort. So the S.G. may increase slightly which will result in a slightly higher final alcohol %.

The amount of S.G. increase is usually too small to account for, but with higher amount of certain specialty malts used it is something to be aware of if you need accurate measurements of S.G. and Alcohol.

ADVANCED RECIPES

WilliamsWarn will have Advanced Recipes on our website in 2013 using our extract as a base plus the addition of steeped hops and steeped grains and other ingredients required to make more beverage styles than the Standard kits we supply.

We adhere to the BJCP Styles Guidelines for most recipes.

Once you have tried some of our Advanced Recipes you will then be in a good position to try the many thousands of recipes on the internet. Recipes titled as “Extract plus Grains” are the recipes types the same as our Advanced Method described here.

WilliamsWarn will also introduce an online database from our website in 2013 so that brewers can exchange recipes and communicate together in a forum style platform.

WILLIAMSWARN

PART FOUR: APPENDICES

APPENDIX ONE: CLEANING & SANITISING

BACKGROUND

The best breweries in the world ensure total cleanliness. As every brewer knows, brewery fermentations are essentially the controlled growing of a single strain of yeast. Unfortunately the conditions for the brewery yeast are also perfect for unwanted bacterial (and other microbes) growth, which can spoil the beverage. This is why cleaning and sanitising are so important.

So to ensure it is only the yeast we pitch into the wort/must that grows, we need to both clean off all organic residues and then sanitise the cleaned surfaces. The cleaner the surfaces the easier it is for the sanitiser to do its job on these unseen micro-organisms that may be there.

As long as we clean and sanitise the brewery well, it's not so critical if the utensils are not 100% clean. So use common sense, but jugs, spoons, scissors, can openers and the table surface you use do not need to be totally sterile. It is more the bugs that can hide inside the brewery and create a home for themselves in some hidden corner that create the problem in the beverage during fermentation or after it is produced.

THE WILLIAMSWARN BREWERY DETERGENT

The detergent used in Stage 1 can be any popular dishwashing powder, although the WilliamsWarn Brewery Detergent is formulated to work well with brewery residue and cold water.

However, it is optimal to use 1 Litre of water that is as warm as you can handle on your hands, in order to assist dissolving the residue from the previous brew.

Detergent is used to remove solid material off the surfaces ahead of the sanitising agent that follows in the next step. WilliamsWarn Brewery Detergent contains a mixture of alkaline cleaning chemicals, water softener, non-ionic surfactants and a small measure of sanitising agent as well.

The most important part to clean in the brewery is the yeast ring that is visible after each brew. By dipping the non-scratch sponge in the liquid detergent and rubbing onto the yeast ring, it should come off reasonable easily. If parts of the yeast ring have dried, those areas may need a bit of extra effort to scrub off. The detergent will get dirty as you clean but it will still have a good cleaning ability regardless.

The detergent will then need a good rinse off with water to remove it from the surfaces.

THE WARM WATER USED

The WilliamsWarn Brewery Detergent can be used in cold water but warm water is always better to help dissolve organic material like the yeast ring and beverage residue.

If you have a hot water system close to a temperature of 60°C/140°F this will work well.

Otherwise the easiest way to make approximately 60°C/140°F water is to mix 50:50 ambient water from the tap with boiled water from a kitchen kettle. Ambient water will fluctuate with the seasons and geographical locations but even a range from 10°C to 30°C (50°F to 86°F) tap water will produce warm water in the range of 55°C to 65°C (131°F to 149°F) once combined with boiling water, which is fine for the purpose of cleaning the vessel.

Once the warm water is put in the 2 Litre jug and the detergent mixed and then added to the cone, the temperature will be closer to 50°C/122°F, which should be acceptable for contact with your hand and scrubbing the vessel with. However if you find this too warm then you should use a colder water temperature.

THE WILLIAMSWARN SANITISING AGENT: SODIUM PERCARBONATE

The WilliamsWarn sanitising agent that follows the detergent is Sodium Percarbonate. Sodium Percarbonate will react in water to form Sodium Carbonate and Hydrogen Peroxide. It is the Hydrogen Peroxide that works as an oxidiser on bacteria and other undesirable microbes.

It requires a contact time of about 2 minutes after wetting, to sanitise the cleaned surface.

After this contact time, the bulk liquid should be drained from all surfaces but there is no need to rinse the sanitizer residue off. This is because it is a no rinse sanitizer.

After a short period of time, it breaks down into oxygen and CO_2, both of which are naturally found in beer and other beverages.

PRESSURISING THE VESSEL DURING CLEANING AND SANITISING.

The gas we add to the vessel in Stage 1 is just enough to push the liquids out the draft tap and packaging line. If you find you need more or less that that suggested then adjust as required. We have found that 0.3bar/5psi is about the right level for what is required, however if you find you need less, that is fine and will save some gas.

We want some flow out the draft tap and filling line to help clean the lines and we also want to have some soaking time in these lines while we clean the vessel itself.

We also want to ensure these lines have a few minutes contact time with the Sodium Percarbonate solution to sanitise them.

THE SPONGE

Use a non-scratch sponge to prevent scratching the stainless steel. The sponge provided is non-scratch. If you use a sponge that scratches the stainless steel, the scratches can be a hiding place for undesirable microbes that don't get in contact with the sanitising agent which then increases the risk of infection.

THE DRAFT TAP FOAM MECHANISM

The draft tap has a beer-foam mechanism. When pushed towards the back of the brewery, it will create foam at the end of a pour into a glass, to give a nice head. Therefore when we clean, we must both pull and push the tap when allowing detergent and sanitising agent to flow out the tap, so that the tap gets a good clean.

THE SEDIMENT BOTTLE

At the end of the brewing process, the sediment bottle should be rinsed and put back on the brewery as a safety measure, in case children open the vessel valve. However just before the next brewing day, when the beverage is almost gone, as an alternative to the clean and sanitisation that occurs in Stage 1, you may instead wash the sediment bottle in a dishwasher. In addition, an alternative to sanitise is to stand the sediment bottle in 80°C/176°F hot water for 2 minutes. The heat will destroy most bacteria even if the bottle isn't cleaned well. The bottle can handle most cleaning agents as well as hot temperatures up to 100°C/212°F.

YOUR OWN TECHNIQUES

You may find your own techniques that are easier for you than our method. You are the brewer and the owner of the brewery, so you may find methods that suit you better.

You may prefer to clean less. It is possible to just give the brewery a decent water scrub and water rinse and brew the next batch without getting an infection. We know brewers who have done this many times with their WilliamsWarn. However, the risk of infection will likely increase over time if you never clean the brewery with detergent and sanitizer.

Or alternatively you may feel we have not cleaned and sanitised enough with our method and you'd like to do more or double the concentrations of chemicals.

Either alternative is fine as long as the beverages you brew taste good and have no off-flavours caused by an infection of unwanted micro-organisms. At the end of the day, the brews you produce will tell you if you are cleaning and sanitising enough.

EMERGENCY SANITISATION

In our first period of selling Personal Breweries, we have had no reports of infection. However if for some reason you suspect you have infections (e.g. sour beverage, major off-flavours) over several brews, the best solution would be to give a good clean with detergent and then a sanitisation with hot water.

Heat is very effective as killing undesirable micro-organisms as it penetrates everywhere.

In this case we would recommend heating 7 Litres (1.8 US Gallons) of water up to 80°C/176°F in a pot and then add this carefully to the cone of the brewery (vessel valve closed) and then close the lid. Wait 5 minutes for the heat to heat-up the vessel and then add 0.3 bar/5psi of pressure to the vessel and push 250ml of this water out the draft tap and filling line. The water will be somewhere above 70°C/158°F at this stage and this is enough heat to kill most beverage spoiling microbes in a few seconds. Allow it to sit for 20 minutes to further heat up the vessel and under the lid. Then release the VPRV after 20 minutes (as there may be a partial vacuum inside, due to the water cooling down) and remove the lid and dump the water out of the vessel and lines.

This should have killed any undesirables.

SAFETY NOTE: Obviously moving a pot of 7 Litres (1.8 US Gallons) of water at 80°C/176°F requires precautions to ensure safety requirements are met. Ensure no children are nearby and take total care moving and pouring the water.

CLEANING THE OUTSIDE OF THE BREWERY

The best way to clean the outside of the brewery is to use stainless steel wipes used on stainless steel refrigerators and handles. In New Zealand and Australia there is a product called Kleenex Viva Stainless Steel Wipes. In the USA there is Weiman Stainless Steel Wipes. Find a similar brand and you will find it easy to remove hand marks and keep the brewery looking shiny.

APPENDIX TWO: ADDING INGREDIENTS

IMPORTANT PRINCIPLES

For ingredient addition, the principles we are adhering to are as follows:

A. The water you use should be drinking water quality. Follow the principle "If you can drink it you can brew with it". Chlorinated water doesn't need to have the chlorine removed but if you have a carbon filter commonly used for that purpose, then that water is also fine.

B. The yeast needs to be rehydrated in 25°C+/-5°C water (77+/-9°F) This temperature is optimal for dried yeast rehydration and water is better than wort/must, as water puts the yeast cells under less osmotic stress during the hydration phase. Tap water (with its naturally dissolved mineral content) or deionised or sterile water all work well.

C. WilliamsWarn liquid and dry malt extracts do not need to be boiled. They have already been boiled in a brewery. The hot water employed is just used to help dissolve the liquid and dry malt extracts more easily.

D. After adding all the ingredients and water, the goal is to achieve a final wort/must volume of 23 Litres (5 UK Gallons/6 US Gallons) and a temperature of approximately 25+/-8°C (77+/-14°F) when you pitch the yeast. This is so the wort/must temperature is within 8°C (14°F) of the yeast that is rehydrating in the water and therefore any "cold shock" to the yeast is avoided when the wort/must added to it.

E. The temperature of the water used in the Standard Method can be adjusted by you in order to achieve this final wort/must target of 25+/-8°C (77+/-14°F) when the vessel valve is opened to the yeast in the sediment bottle. You may need to make adjustments depending on the season you are brewing in and the temperature of your cold water. You can add more hot water when you fill up the vessel, instead of cold water, if your water source is too cold. Alternatively you can reduce the temperature of the hot water the LME is dissolved into if your cold water is too warm. Using our Standard Method instructions, the final wort/must temperature will vary as shown in the table below, depending on your local cold water temperature.

LOCAL COLD WATER TEMPERATURE °C (°F)	FINAL WORT/MUST TEMPERATURE BEFORE PITCHING THE YEAST (USING STANDARD METHOD) °C (°F)
12°C (54°F)	17°C (63°F)
15°C (59°F)	20°C (68°F)
18°C (64°F)	23°C (73°F)
20°C (68°F)	24°C (75°F)
23°C (73°F)	27°C (81°F)
25°C (77°F)	29°C (84°F)
28°C (82°F)	31°C (88°F)
30°C (86°F)	33°C (91°F)

If your local cold water temperature is lower than 12°C (54°F) or above 30°C (86°F) you will need to add some adjustments as follows:

1. If your cold water temperature is between 7-12°C (45-54°F), add 1 Litre (2 US pints) of boiling water before reaching the 23 Litre mark, in order to bring the final wort/must temp to about 20°C (68°F). If your local water is below 7°C (45°F), add 2 Litres of boiling water before reaching the 23 Litre mark, to bring your wort/must temperature to about 20°C (68°F).

2. If your local water temperature is between 30-35°C (86-95°F), then dissolve the liquid extract in the 2 Litre jug and empty can in Stage 2 in 50°C (122°F) water rather than boiling water. If your local water temperature is higher than 35°C (95°F), you will need to cool the wort/must to 25°C before adding the yeast to it, by setting the temperature controller to 25°C (77°F) and waiting until temperature is achieved.

F. Avoiding Cold Shock: In any case, no matter what the difference is between your wort/must and yeast, you can reduce any cold shock issues by just adding the wort/must in parts when you open the vessel valve to the sediment bottle with the rehydrating yeast in it. If you add the wort/must slowly and once the yeast liquid volume is doubled (e.g. 500ml) then wait a few minutes. The yeast will get used to the temperature of the wort/must. Then add the rest of the wort/must.

Adding wort/must that is 8°C (14°F) colder than the yeast is more of an issue compared to the opposite. But the temperature of the yeast and wort/must should not exceed 35°C (95°F) in general, to avoid overheating the yeast.

If the temperature of the yeast and wort/must are within 8°C (14°F), you don't in essence need to add the wort/must in parts as we have written in Stage 2 and you can just open the valve and add it all. However it's a good safety precaution to do a part fill for 1 minute in any case, to get the yeast used to any quick temperature difference, so we've stated it as a standard method in the instructions.

This technique also reduces osmotic stress on the yeast by allowing the yeast to accustom itself to wort at half strength for a short period.

G. After the yeast has been added to the wort/must, the fermentation temperature is then set. In this way, the yeast has time to fully rehydrate and adjust to its new wort/must environment at the temperature described above and the brewery then moves the wort/must, over some time, to whatever fermentation temperature is set.

YOUR OWN TECHNIQUES

You may find your own techniques that are easier for you than our method. You are the brewer and the owner of the brewery, so you may find methods that suit you better. As long as you meet the above general principles, you may add ingredients in any manner.

If in doubt, experiment and find out!

ADDING DME

Dry malt extract is very hydroscopic and may form clumps when added but as long as 90% of it is dissolved, move onto the next step. Residual clumps will dissolve over time.

If you intent to measure the SG of your wort/must to be able to calculate the alcohol content of your final beverage, then you need to dissolve all the DME. This is better done by adding the DME in smaller amounts and stirring before adding the next amount.

If you do not intend to measure the SG then some clumping is acceptable and it's easier to just add the DME one bag at a time and stir it all in, accepting some lumps that will dissolve by themselves over the next few hours in the vessel.

For the Standard Method we have purposely planned the addition of the DME to be into approximately 45°C (113°F) water in the cone, as we have found it dissolves well at this mid-warm temperature.

ADDING LME

Liquid Malt Extract is best stored cold in a refrigerator to avoid it ageing. However cold extract is difficult to pour, so take it out of the fridge the night before you use it so it can warm up and pour more easily. Alternatively you can warm it up in hot water for 15 minutes before opening. Remove the yeast sachet from under the can lid if you are going to heat up the LME, as the heat will damage the yeast.

It is important to dissolve all the liquid malt extract before adding it. This is to avoid osmotic stress on the yeast should they come into contact with un-dissolved liquid extract.

THE ALCOHOL CONTENT OF BEVERAGES USING THE STANDARD METHOD

A 1.7kg (3.74 lb) can of LME plus a 1kg (2.2lb) bag of DME made up to 23 Litres will give a wort/must of 1.040.

The wort/must will then get fermented down to a minimum SG at the end of fermentation that is dependent on the residual starch in the ingredients (which cannot be eaten by the yeast) and the yeast strain used.

The table below shows the alcohol content for 5 different final SG readings.

FINAL SPECIFIC GRAVITY (SG)	ALCOHOL % (IF ORIGINAL GRAVITY (OG)) IS 1.040
1.006	4.56%
1.008	4.29%
1.010	4.02%
1.012	3.75%
1.014	3.49%

To increase the alcohol content, you need to add more ingredients. For more information on alcohol calculations, see Appendix 3 Taking SG samples and calculating alcohol %'s.

APPENDIX THREE: TAKING S.G. SAMPLES AND CALCULATING ALCOHOL %'S

In order to calculate the alcohol content of a brew, you need to take two samples:

1. The Specific Gravity (SG) of the initial wort/must on Day 0 when it is made. This measurement is also known as the Original Gravity (OG).
2. The Specific Gravity (SG) of the final beverage after fermentation and when cold (preferably after clarification). This measurement is also known as the Final Gravity (FG).

From these two measurements we can calculate the alcohol %. The higher the initial SG, the higher the alcohol % will be and the lower the final SG, the higher the alcohol % will be.

TAKING AN INITIAL SG SAMPLE

When the wort/must is full in the vessel and before the yeast is added, give it a good stir so that all the contents are mixed well. Take a 100ml sample out of the top surface using a clean glass and add this to the 100ml measuring cylinder. Then add the hydrometer to the cylinder and give the hydrometer a spin as you let go. The spinning helps remove air bubbles from the hydrometer. Let the hydrometer come to a stop and then measure the SG. An example is shown in Figure 62.

Fig. 62

You may need to blow off any bubbles so you can read the hydrometer better. Then read off the scale at the top point of the liquid where it rises and touches the hydrometer. Note: some hydrometers require a slightly different reading point, so read the instructions of the hydrometer you have.

For a WilliamsWarn Standard Kit consisting of a 1.7kg (3.75 lbs.) can of liquid malt extract and a 1 kilo (2.2 lbs.) pack of dry malt extract made to 23 Litres (5 UK Gallons/6 US Gallons), the SG will be 1.040.

Specific gravity is a measure of density. Water has a density of 1.000 SG. So 1.040 means the wort/must is denser than water due to the dissolved matter from the barley grain or other raw materials that are now in your fermenter along with the water. This includes various sugars, proteins, amino acids, minerals and vitamins and other compounds.

To get the most accurate reading, the temperature of the sample should be 20°C (68°F). A few degrees on either side doesn't matter too much, but the closer you are to this target the more accurate the reading. Note: Some hydrometers have different calibration temperatures than this, so read the instructions of the hydrometer you have.

SAMPLING DURING FERMENTATION

Once the pressure has built up in the unit, you can take a sample out of the draft tap at any time. If you'd like to measure the SG each day you may do that. However unlike the wort/must sample, there are now carbon dioxide bubbles in the fermenting beverage so you need to de-gas it first. Take 50ml of the beverage out of the draft tap and discard this down the drain, this will clear the line so that you may sample the fresh beverage. Then take a 150ml sample from the tap and pour it between two glasses for a minute to create turbulence and remove the CO_2. The more turbulent the pouring between the glasses, the more the removal of CO_2. Then let it settle and ensure it's close to 20°C (68°F) in temperature and then add it to the measuring cylinder. Add the hydrometer with a little spin and read the SG.

Different yeast will ferment at different speeds and different fermentation temperatures also affect the rate. Some graphs

of typical fermentation rates, as measured by the drop in SG, are shown is Appendix 7.

The yeast is consuming the sugars, amino acids, vitamins and minerals and excreting alcohol and CO_2 from its cells into the wort/must. The SG reduces each day because these compounds, which are denser than pure water, are being reduced in quantity. Most of the resulting CO_2 is emitted out the VPRV (we keep about 10%) and the alcohol stays in the beer. The alcohol is also less dense than water so the more that is made the lower the SG becomes as well.

Beers will eventually stop at a certain SG depending on residual starch in the ingredients and the yeast type. Yeast cannot eat sugar molecules above 3 sugar units long and these remain in the beer to give body and some taste. The amount of these starches (or "dextrins") depends on how the malted barley was mashed, the stage in a brewery brewhouse when crushed grains are mixed with water and starches are converted into sugars.

For extracts like WilliamsWarn extracts, this is controlled when the extract is made. All grain brewers can control this themselves depending on their temperature and time regimes during mashing.

Ingredients made up of mainly sugar, like the musts of cider, wine and mead, will ferment right down as they have no residual dextrins because the raw material is fruit or honey, not starchy grains.

SAMPLING AFTER FERMENTATION

Once fermentation is complete, the SG will not reduce any lower and you can take a final SG sample. This could be before cooling if the yeast has finished fermenting, but the most accurate reading is at the very end when the beer is cleared. This is because if fermentation hasn't stopped during cooling, the SG will continue to lower, and in addition, the clarification process mixes that entire tank contents very well to make sure you get an accurate reading of the total tank SG.

You will need to take a sample, ensure it is close to 20°C (68°F) and de-gas the beverage by pouring 150ml between two glasses before putting it in the measuring cylinder with the hydrometer.

To increase a cold beverage's temperature, you can hold the glass of sample under a tap of ambient or slightly warm water while swirling the glass to get a good heat transfer. Then measure the SG as described above.

CALCULATING % ALCOHOL BY VOLUME (ABV)

There are various calculations to calculate alcohol by volume (ABV) from an initial and final SG reading.

Here are some options (you may find others on the internet).

A. A basic calculation is:

   (Initial SG x 1000) – (Final SG x 1000)/7.46

   So for a beer starting at 1.040 and finishing at 1.010, the alcohol content by this formula will be (1040-1010)/7.46 = 4.02% alcohol by volume.

B. Another simple formula is that is commonly used is:

   ABV = (Initial SG - Final SG) x 131

   So in this example:

   (1.040 – 1.010) x 131 = 3.93% abv.

   You will note there is a discrepancy between the formulas. These formulas provide a guideline only as true alcohol is measured in a lab from the final beverage using equipment a homebrewer does not possess, so different authors prefer slightly different formulas.

C. A more complex formula which attempts to provide greater accuracy at higher specific gravities is:

   ABV = (76.08 x (Initial SG-Final SG)/(1.775-Initial SG)) x (Final SG/0.794)

   You may want to use this for beverages that have an initial SG above 1.060.

   Using formula A, you can see the effect of a lower Final S.G. on the ABV.

ORIGINAL SG	FINAL SG	ABV%
1.040	1.013	3.62%
1.040	1.012	3.75%
1.040	1.010	4.02%
1.040	1.009	4.15%
1.040	1.008	4.28%
1.040	1.007	4.42%

The yeast we use for our extracts all ferment to this range, so for the same starting point with a Standard WilliamsWarn Kit you will end up with slightly different alcohol %'s.

S-33 used in several of our ales will ferment very quickly, almost in 1 day, and stop at about 1.013. We therefore use it for ales that people may like to make quickly (in less than 7 days by shortening the fermentation time to 2 days not 4 days) and that suit some residual body in the beer. If you like to increase the alcohol content of beers from our Standard Kits made with S-33, simply add some more DME or dextrose (glucose). See the next section below for details.

Nottingham Ale yeast will ferment to about 1.010 in 3 days to make 4% alcohol ales and we use this with our English beer styles.

S-23 and W34/70 are lager yeasts and will ferment slower than the ales (they are also fermented at lower temperatures which slows the process down) but they reduce the SG further to about 1.008 in 5 days. They therefore produce 4.3% alcohol lagers for 1.040 initial SG worts.

For our Belgian Beer we use T-58 which will end at about 1.012.

Our cider when added as two cans will produce a 1.036 must but it will ferment all the way to 1.000 or just below and produce a 5% alcohol cider. To leave some residual sweetness in that cider kit you can put the cooling on before the fermentation is finished to end at 1.006 which will result in a 4.02% cider.

HOW TO INCREASE THE ALCOHOL CONTENT OF THE STANDARD KITS

To increase the alcohol content you need to add more extract or sugar to the wort made up to 23 Litres (5 UK Gallons/6 US Gallons).

For beers it is better to add liquid or dry extract made from barley but a certain amount of dextrose (glucose) sugar is acceptable as long as it isn't more than 20% of the total ingredients in terms of extract added (liquid malt extract is 80% extract, dry malt extract is about 98% extract and sugar is 100%). Too much sugar makes for a bad flavour for beers.

NOTE: German brewmasters will never add sugar as an ingredient in beer due to the famous German Beer Purity Law from 1516 known as the Reinheitsgebot. So only add DME if you're making a German style beer and want to increase the alcohol. Check the BJCP Guidelines as highlighted in Appendix 10 for details on what ingredients are allowed for what beverage style.

Fruit beverages such as cider, mead and sparkling wines can handle a higher addition of sugar to boost alcohol or cheapen the total ingredient cost.

If we assume dry malt extract/sugar is added to a Standard WilliamsWarn Kit, the approximate increase in initial SG is shown in the table below. If we assume a resulting final SG of 1.010, the different alcohol %'s can be seen also.

DME / SUGAR ADDED	INITIAL SG	FINAL SG	ABV %
0g/0oz	1.040	1.010	4.02
250g/8.8oz	1.044	1.010	4.58
500g/1.1lbs	1.048	1.010	5.15
750g/1.7lbs	1.053	1.010	5.71
1kg/2.2lbs	1.057	1.010	6.27
1.25kg/2.8lbs	1.061	1.010	6.84
1.5kg/3.3lbs	1.065	1.010	7.40
1.75kg/3.9lbs	1.690	1.010	7.96
2kg/4.4lbs	1.074	1.010	8.53
2.5kg/5.5lbs	1.082	1.010	9.65
3kg/6.6lbs	1.090	1.010	10.78

In reality, the higher you go in initial SG, the more alcohol is produced, but this also has an effect on the yeast and it will not be the case that a final SG of 1.010 is reached for every yeast type.

As higher alcohol levels are produced, some yeast will likely not ferment all the way down and the final SG will finish a bit higher, but the table serves to show how you can increase the final % ABV by adding more ingredients to the same 23 Litre final volume in a WilliamsWarn.

Very roughly, for every 500 grams (17.6 oz) of DME or sugar to a 23 Litre batch, you will increase the final alcohol by approximately 1% ABV.

APPENDIX FOUR: THE LID SEAL

SEAL POSITION

It is critical that the tank seal is sitting properly in the groove of the tank rim. It is important that this seal is sitting in the groove along the entire circumference, as shown in Figure 63.

The seal circumference is designed to be slightly smaller than the groove circumference, in order to give a better seal when closed.

However if the seal is rising over the lip of the groove towards the centre of the tank (see Figure 64), take the seal out and give it a very gentle stretch at a couple of points on its circumference (see Figure 65). Be careful not to overstretch the seal.

Place the seal back in the groove and check it sits in the groove entirely (Figure 63).

This step is important as it ensures a build-up of pressure during fermentation and also cleaning when the tank gets manually pressurised.

FOOD GRADE SILICON GREASE

As an extra step, food grade silicon grease can be put on the seal to assist in both sealing the pressure better (if you feel there may be a small leak) and also removing the lid more easily when the brewery is empty.

On occasions, the lid may be hard to remove for one person if the lid thread and rim thread bind too well. If this happens, ask another person for assistance and the lid will come off easily. It comes off counter-clockwise.

Silicon grease applied to the seal as shown in Figure 66 may help with this lid removal if you find it occurs too often. It is important however to only apply the grease to the seal surface as grease (and fat and oil) can be detrimental to beer foam and cause the foam to collapse too quickly in the glass when the beer is poured, if somehow it manages to mix with the beer in the vessel.

Fig. 63

Fig. 64

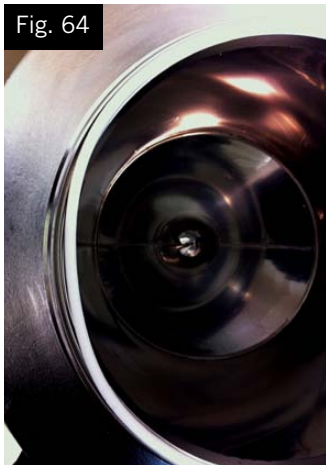


Fig. 65

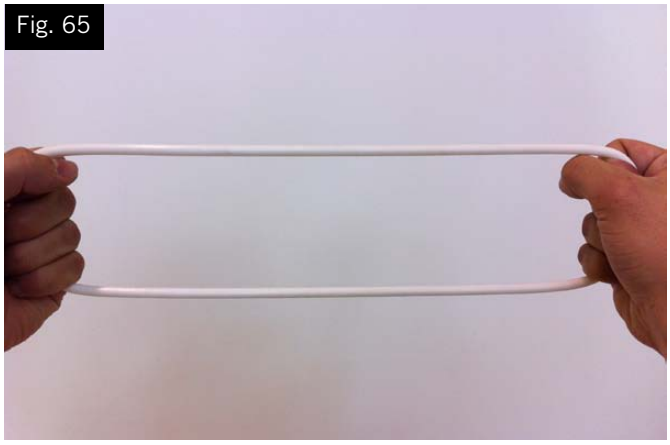


Fig. 66

APPENDIX FIVE: THE VPRV AND CARBONATION

BACKGROUND

For the average 5% alcohol beverage, the yeast produces during fermentation about 10 times the carbon dioxide we need in the final beer. So we only need to keep about 10% (and let the rest escape) and the beverage is fully carbonated.

The WilliamsWarn is designed to be able to retain the required amount of carbon dioxide for a range of beverages. We control the amount of retained carbon dioxide by controlling the pressure during fermentation and this we do by setting the VPRV (Variable Pressure Relief Valve) at a certain pressure relief point.

The pressure builds during the first day of fermentation for ales and 2nd day for lagers and then automatically releases to emit the excess carbon dioxide we don't need. But by then the beverage is fully carbonated and that is the advantage of the WilliamsWarn – there is no need to keg or bottle flat beer and then go through a specialised carbonation step after fermentation is over.

CARBONATION LEVELS FOR BEVERAGE STYLES

Carbonation is a function of temperature and pressure. So when we chose a brew to make, we need to first choose the carbonation level we want and the dispense temperature we want and then we can calculate the correct pressure we need to dispense at.

This knowledge then tells us what pressure to ferment at and control to on the first few days with the VPRV.

Different beverages traditionally have different final carbonation levels. These can be seen in the Table 1 below.

TABLE 1

BEVERAGE	TYPICAL GRAMS PER LITRE CO_2
British Ales	3.0 - 4.0
Porter, Stout	3.5 - 4.5
Belgian Ales	4.0 - 4.5
American Ales	4.5 - 5.5
European Lagers, Belgian Lambics	5.0 - 5.5
Some Lagers, New World Ales	5.5 - 6.0
Cider and Mead	Still - 8.0
American Wheat	5.5 - 6.5
German Wheat Beers	6.5 - 8.0

These are guidelines only and you may prefer to produce a highly carbonated English Ale if that is your personal preference. However in beer competitions, being closer to what is traditional may be important with regards to the scoring system beer tasting judges may use.

Different beverages traditionally have different final temperatures they are consumed at. Some approximate guidelines can be seen in Table 2 below.

TABLE 2

BEVERAGE	TYPICAL SERVING TEMPERATURE
Lagers	2 - 7°C / 36 - 45°F
Ales in New World Countries	2 - 8°C / 36 - 46°F
Wheat Beers	6 - 10°C / 43 - 50°F
British and Belgian Ales	7 - 13°C / 45 -55°F
Cider and Mead	5 - 16°C / 41 - 61°F
Strong Dark Ales and Barley Wines	10 - 15°C / 41 - 61°F

These are also guidelines and you as the brewer may choose to dispense at a temperature not within these ranges, if that is your personal preference.

SETTING YOUR CARBONATION LEVEL

Carbonation is a function of temperature and pressure. You can control the amount of carbonation you want in the final beverage by the following steps.

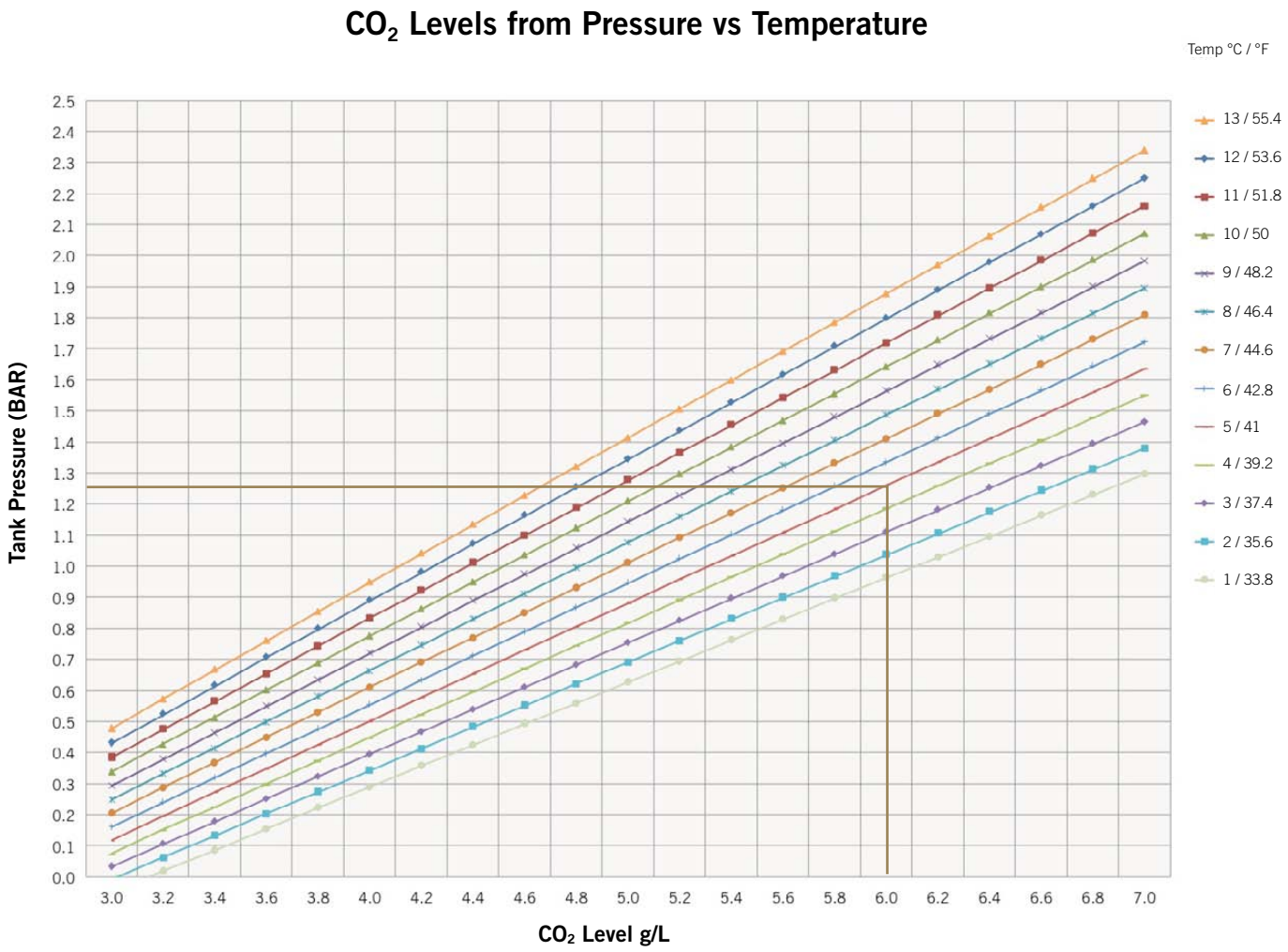
Step 1: Decide what level of CO_2 you want as read from Table 1.

Step 2: Decide what temperature you want to drink the beverage at as shown in Table 2.

Step 3: Use Chart 1 to determine what final dispense pressure you need on your gas cylinder (the y-axis on the graph) in order to achieve this level of carbonation. Start on the x-axis at the carbonation level you want, take a vertical line up to the line on the graph for your chosen temperature. The lines on the chart read off a range from 1°C to 13°C (34-55°F). Then take a horizontal line left to the vessel pressure you will need when dispensing the beverage.

Step 4: Set you gas cylinder regulator at this pressure setting.

CHART 1



Step 5: Set the VPRV 0.25 bar higher than the gas cylinder setting and brew at this pressure (see below for more details on setting the VPRV).

For example, we recommend that first time users carbonate to the high end of the range for lagers, which is 6 g/l, and set a drinking temperature of 5°C. Reading from Chart 1, the 5°C line intersects with 6 g/l (the x-axis) at 1.25 bar on the y-axis. Therefore the required dispense pressure on the gas cylinder is 1.25 bar. The VPRV must then be set 0.25 bar higher than this at 1.5 bar which is the pressure during fermentation that you need to control to.

VESSEL PRESSURE CONTROL DURING THE BREWING PROCESS TO ACHIEVE THE FINAL CARBONATION LEVEL

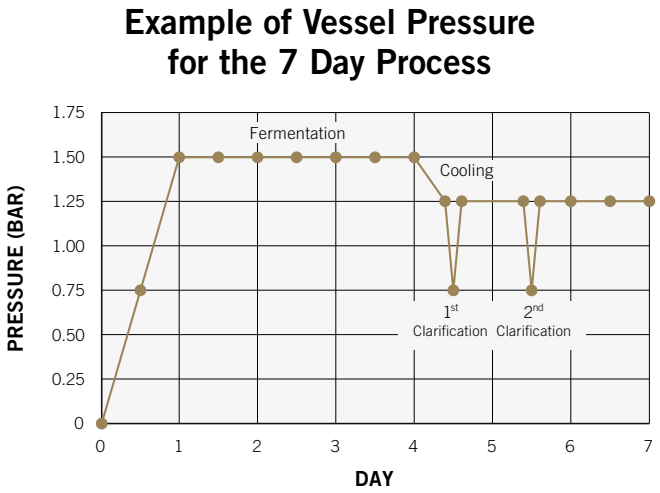
Chart 2 shows the pressure in the vessel during a typical 7 day ale brewing as described above.

During fermentation you will need to fine-tune the VPRV setting to achieve the vessel pressure required. E.g. 1.5 bar for first-timers.

After cooling, the pressure will reduce about 0.25 bar, to about 1.25 bar in this example.

During clarification, you will then release pressure out of the VPRV by pressing on the release button, to achieve a vessel

CHART 2



pressure of 0.75 bar, in order to create a 0.5 bar pressure differential between the vessel and the gas cylinder (which is set at 1.25 bar in this example for first-timers). You will then turn the 3-way valve to the clarification pot with clarification agent in it and this will bubble the agent into the beverage which will

increase the pressure back to close to 1.25 bar. You will do that again after a 1 day waiting period.

After clarification the vessel will therefore be near the dispense pressure that the gas cylinder is set at and you can connect the gas cylinder to the vessel by opening the 3-way valve. You will then wait 1 ½ more days for a final clearing and then begin to consume the fully carbonated beverage.

We have used a 0.5 bar pressure differential for clarification to be sure first time users clear their beers, but this can be reduced to 0.25 bar and clarification also achieved. Any pressure differential less than this will likely not mix the clarification agent well enough into the beer.

Note: We describe two methods on how to release the pressure during a clarification. In the main instruction we use a method for beginners where they carefully create the pressure differential before opening the 3-way valve. In Appendix 8 we describe another method that experienced brewers may like to try, where they turn the 3-way valve and then release the pressure and control clarification by the amount of bubbling that is heard. This method requires experience with regards to knowing the amount of vigorous bubbling that is heard (for adequate mixing) and what a successful clarification process is. See Appendix 8 for details.

PRESSURE CONTROL FOR LOW CARBONATED BEERS

When you brew beers at a very low carbonation level, another clarification technique is required. This is because the pressure is so low, we cannot release gas from the vessel via the VPRV lower than atmospheric pressure (0 bar) and so the first clarification method described above cannot work. For example, if you're making an English Ale at 5°C and want a carbon dioxide content of 3 g/l, you only need 0.12 bar pressure in the vessel, which is very low. So you cannot release 0.25-0.5 bar out of the vessel as described in the first method when making well carbonated beers.

In this case you need to brew with the VPRV set at about 0.25 bar above the level of carbonation you want (to allow for the drop in pressure when the cooling is put on) and set the gas cylinder at 0.5 bar above that (to create the pressure differential). Then clarify as per normal and the gas bottle pressure will force the clarification agent in the beer. The pressure will increase in the vessel and it should release itself out of the VPRV. When you've finished clarifying, you then should release pressure out of the VPRV to the level you want in the final beer.

You will clarify a second time using the same principle. Once you have finished the second clarification, release the increased gas in the vessel again to the pressure (and therefore carbonation level) you want. Then after this, you will finally set the gas cylinder at the same pressure which is your chosen dispense pressure, and open the 3-way valve to the vessel. When you dump the sediment bottle after 36 hours, the beer will be at the correct pressure and carbonation.

The difference with this method is that you cannot set the gas cylinder at the pressure you want in the final beer during dispense until after you have clarified. With higher carbonated beers as described in the first method above, you can set the gas cylinder pressure at the beginning of the process and not change it and use the VPRV to make the pressure differential by releasing pressure from the tank.

In either case the principle is the same in that a pressure differential of 0.25 -0.5 bar is required between the vessel (at the lower pressure) and the gas cylinder (at the higher pressure) in order to force the clarification agent in when the 3-way valve is turned to the clarification pot.

MONITORING THE PRESSURE IN STEP 3 AND ADJUSTING THE VPRV SET POINT.

When you brew, you will need to use the pressure in the tank during fermentation to set the VPRV at the pressure you desire.

Winding the screw down (clockwise) will increase the vessel pressure required to release the spring and winding it out (anti-clockwise) will lower the vessel pressure required to release the spring.

To test any new setting the vessel will need to be pressurised and the vessel pressure gauge read when the sound of gas emitting from the VPRV is heard. This can be done at any time by adding gas from the gas cylinder to the vessel. However it is easiest and results in less loss of bottle gas if performed during fermentation when the yeast is making excess CO_2.

So for your first brew, set the VPRV at 2 ½ turns counter-clockwise for fermentation. This is approximately the release point of 1.5 bar. During the first day (for ales and 2nd day for lagers) the pressure will build up and you can adjust the setting.

If the vessel pressure is below or above the set point, the VPRV needs to be adjusted. It is important the pressure be near the target (e.g. 1.5 bar for first time users). You don't need to be 100% accurate as we're fermenting at a level slightly higher than we actually need but get as close to this as possible. Excess gas will be released manually during the clarification phase. The yeast makes it for free and we are in fact keeping about only 10% of what the produce, so it's no issue to ferment at a higher pressure and release later.

Therefore, during fermentation, if the pressure in the vessel is too high above target, unscrew the VPRV slightly (anti-clockwise) until gas is heard to be emitted at the desired set point.

If the VPRV is releasing below target (as heard and smelt off the VPRV and read on the vessel pressure gauge), then you need to wind the VPRV down a bit (clockwise) and let the pressure build up and then adjust further.

If you want to set it there and then without waiting, you'll need to add some gas from the gas cylinder to the fermenting brew in the vessel by turning the 3-way valve to the vessel and adding e.g. 0.3 bar pressure above the target as read on the vessel pressure gauge and then close the 3-way again. Then unscrew the VPRV anti-clockwise until gas is heard to be emitted at the desired set point.

After a few brews you will know where to set your VPRV for any desired target but you'll likely always need some fine-tuning in the first few days of any fermentation.

THE VPRV DURING DISPENSE

When the vessel is being dispensed, it is best to have the VPRV at maximum to keep its release point as far away from the gas cylinder setting as possible. So set it at maximum pressure during dispense by screwing it right down (clockwise). If the VPRV is set too close to the gas cylinder pressure during dispense, a small amount of gas from the gas cylinder may emit out the VPRV which is a waste of good carbon dioxide.

APPENDIX SIX: SETTING THE TEMPERATURE WITH THE DIGITAL CONTROLLER

The WilliamsWarn uses an Omron digital controller to control the temperature.

To set the temperature the brewery must be turned on. Then use the up and down buttons on the front of the controller to set to the desired temperature (See Figure 67).

The WilliamsWarn uses a glycol jacket to warm or cool the beverage to achieve set point.

You can read both the setting and the actual temperature on the controller face.

Small indicators light up when either cooling or heating is being used.

It takes a few hours to cool the tank from fermentation temperature to dispense temperature, but we allow a full half day to be sure the entire contents are the same temperature.

The temperature range the brewery can be set at is 1°C to 26°C (34 –79°F).

Fig. 67

1. ACTUAL VESSEL TEMPERATURE
2. VESSEL TEMPERATURE SET-POINT

APPENDIX SEVEN: TYPICAL FERMENTATION CHARTS & WHEN TO COOL THE BEVERAGE

TYPICAL FERMENTATION CHARTS

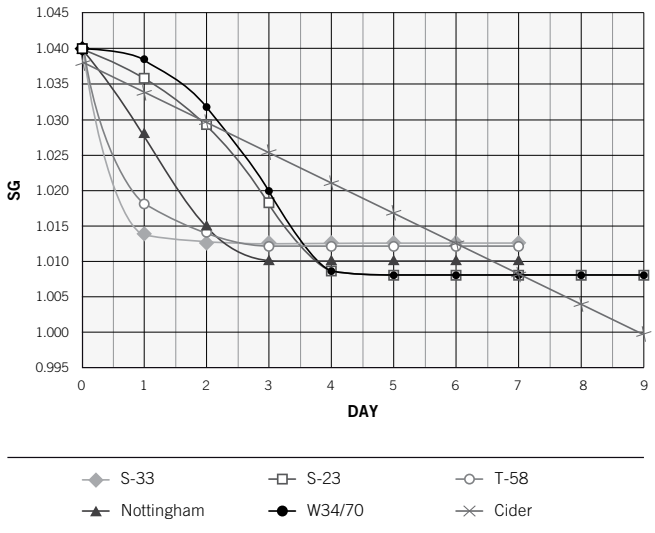
Fermentation is a process by which yeast cells consume nutrients and grow under anaerobic conditions and excrete carbon dioxide, ethanol, flavours and other bi-products from their cells.

The way brewers typically measure the progress of a fermentation is by measuring the specific gravity (density) of the wort or must.

A standard 4% beer typically starts at 1.040 SG and ferments down to 1.010. The difference in starting and finishing SG is caused by both the reduction of dense nutrients in the wort/must by the yeast (sugars and proteins) and the production of ethanol which is less dense than water (water has an SG of 1.000).

CHART 1

Specific Gravity Reduction from 1.040 SG During Fermentation – 3 Ale, 2 Lager & 1 Cider Yeast



Beers usually have some residual starch or dextrins in them which the yeast cannot consume but beverages made from fruit (cider and wine) or mead (made from honey) are made of simple sugars and the yeast can ferment them right down.

Chart 1 shows typical reductions in SG for 3 ale yeast and 2 lager yeast used in WilliamsWarn Standard Kits.

S-33, Nottingham and T-58 are ale yeast that ferment warm (e.g. 23°C/73°F). Ale yeast ferment faster than lager yeast in general but also due to the warmer temperatures used.

S-33 ale yeast will ferment to almost its limit in 1 day. It is a very fast fermenter. S-33 finishes at a higher SG than the other yeast so is used in ales that can be brewed very quickly and suit having a decent amount of body. A S-33 ale fermented from 1.040 to 1.013 will have an alcohol content of 3.62% ABV.

If more alcohol is required the best thing to do is add some more DME or dextrose (glucose) into the mix when the wort is made on Day 0. For example, adding an extra 500g (17.6 oz.) will increase the initial SG to 1.048 and increase the final alcohol to 4.7%, but still with decent body remaining in the beer.

S-33 can tolerate high alcohol fermentations very well.

Nottingham Ale yeast will be finished fermenting close to Day 3 and we give an extra day warm maturation to be sure. Nottingham will produce a 4.02% alcohol by volume beer when fermenting from 1.040 to 1.010. Nottingham can produce higher alcohol beers when more DME or sugars are added in the mix.

T-58 ale yeast is used for Belgian Ales and wheat beers and will ferment quickly and then have a slow end where it takes a few days to finish. It will produce a 3.75% alcohol beer when fermenting from 1.040 to 1.012. It also can produce high alcohol beers when more DME or dextrose (glucose) is added at the start.

S-23 and W34/70 are lager yeasts which are fermented at colder temperatures compared to the ales. Lager yeast tend to grow more slowly than ales in general so therefore take a little longer to get going. The total fermentation time is longer by two days but should be finished by Day 6 as shown in the chart. They will finish at about 1.008 when used in a WilliamsWarn Standard Kit and therefore produce 4.28% ABV lagers/pilsners with an initial SG of 1.040.

It is important to note that a "diacetyl rest" at a warm temperature is recommended during fermentation for lager yeast to achieve the 6 day target. Please see more details below regarding this (see Chart 3).

The yeast we use for our cider is a yeast from Fermentis called S-04. It is an ale yeast that sediments very strongly and when used in our cider, requires no clarification. It will sediment early after the start of fermentation and ferment from the sediment bottle. It therefore ferments slower than our other yeast, as seen in Chart 1. Our cider, when added as two cans, will produce a 1.038 must but it will ferment to 1.000 (the gravity of water) and produce a 5% alcohol cider. To leave some residual sweetness in that cider kit, you can put the cooling on before the fermentation is finished, to end at 1.008 which will result in a 4.02% cider. You will need to be taking SG measurements to control this (See Appendix 3).

WHEN TO COOL ALES

WilliamsWarn will continually grow its products and introduce more yeasts over time, but in general it would be expected that we'll chose ale yeast that are finished by Day 4 and lager, cider and other yeast that will be finished in 6 days for 1.040 initial SG beverages.

A typical 1.040 (initial SG) ale fermentation chart with Nottingham ale yeast in a WilliamsWarn is shown in Chart 2.

Once all the ingredients have been added, the temperature will be somewhere near the fermentation temperature of 23°C (73°F) and once you have set the temperature it will control at that set point for the first 4 days.

The fermentation starts fast enough that the pressure should be at 1.5 bar by Day 1, as shown on the chart and the beer will be fully carbonated, releasing the excess gas you don't need through the VPRV.

By Day 3, the final SG has been reached and we then give 1 more day warm maturation.

T-58 will also be finished in about this time frame and S-33 is a faster fermenter so is finished on Day 2.

So on Day 4, you can put the cooling on for our ale yeast for 1.040 SG beers. If you would like to take SG samples to check each day, or on Day 4, you can do this by taking a sample out of the tap (See Appendix 3 for details).

However as a rule, WilliamsWarn Standard Kits should reach the final SG's each time and you can check fermentation is finished by looking into the sediment bottle and confirming you have a decent amount of settled yeast and almost no bubbles rising anymore.

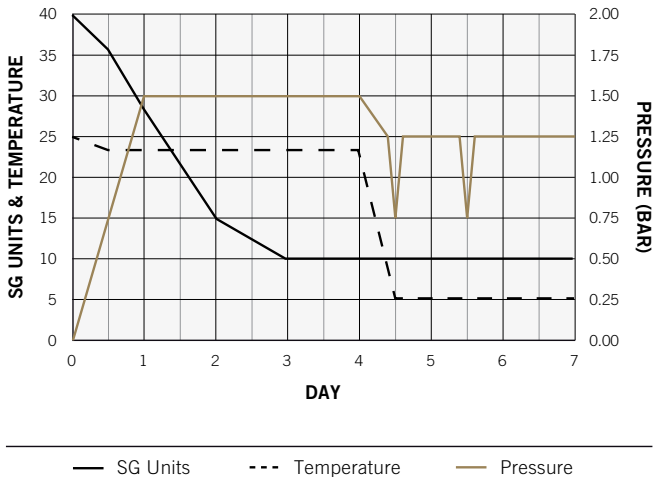
This 4 day rule will be true probably up to about 1.055 initial SG made with these 3 ale yeast. However it is a good policy to take a sample on Day 4 to ensure a higher alcohol fermentation has finished before you put the cooling on.

Ales at higher initial SG's will likely need an extra day or two depending on how high you go. All these 3 ales yeasts can ferment up to 8% alcohol by volume quite easily, which is a starting SG of about 1.070 (an extra 1.75kg of DME added to a Standard Kit).

NOTE: With increasing initial SG's, it is quite important to make sure the largest proportion of what you add is liquid or dry malt extract and not just sugar. The yeast needs the proteins in the malt extract to make more yeast cells to ferment bigger beers.

CHART 2

A Typical 1.040 Fermentation with Nottingham Ale Yeast – 7 Day Process



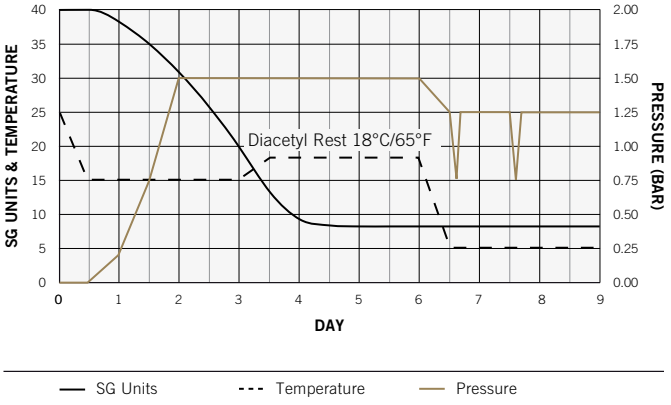
NOTE: The sharp drops in pressure in the chart on Day 4.5 and Day 5.5 are indicative of the Clarification Process when we create a pressure differential of 0.25-0.5 bar between the vessel and the gas cylinder in order to force clarification agent into the beverage. This is described in Appendices 5 and 8.

WHEN TO COOL LAGERS

A typical 1.040 (initial SG) lager fermentation chart with S-23 or W34/70 lager yeast in a WilliamsWarn is shown in Chart 3.

CHART 3

A Typical 1.040 Fermentation with Lager Yeast – 9 Day Process



The initial temperature will likely be above 20°C/68°F and we recommend fermenting at 15°C/59°F so it will take a few hours after pitching the yeast for the temperature of the vessel to reach target.

Lager yeast ferment slower than ales and at a lower temperature, so the start to a lager fermentation takes longer. After 1 day, the pressure will start to build and a pressure of 1.5 bar should be reached before Day 2.

After 3 days fermentation, you need to change the temperature setting to 18°C/65°F. This increase in temperature is to speed up the reduction of a flavour that the yeast has produced, called Diacetyl. This chemical has a sweet butterscotch flavour and is normally seen as an off-flavour in lager. The exception is Pilsner Urquell from the Czech Republic, whose brewmasters like a little bit of Diacetyl in their famous pilsner. This temperature increase is called a Diacetyl Rest or Ruh or The Narziss Fermentation after the famous German Brewing scientist.

The SG for a 1.040 lager should be at 1.008 by Day 5 and we give one day more extra warm maturation.

So on Day 6, you can put the cooling on for our lager yeast for 1.040 SG beers. If you would like to take SG samples to check each day or on Day 6 you can do this by taking a sample out of the tap (See Appendix 3 for details).

However as a rule, WilliamsWarn Standard Kits should reach the final SG's each time and you can check fermentation is finished by looking into the sediment bottle and confirming you have a decent amount of settled yeast and almost no bubbles rising anymore.

This 6 day rule will be true probably up to about 1.055 initial SG made with these 2 lager yeast. However it is a good policy to take a sample on Day 6 to ensure a higher alcohol fermentation has finished before you put the cooling on.

Lagers at higher initial SG's will likely need an extra day or two depending on how high you go. For lagers at above 8% you may need an extra packet of yeast pitched at the beginning of fermentation.

NOTE: As mentioned in the note for ales, the sharp drops in pressure in the chart on Day 6.5 and Day 7.5 are indicative of the Clarification Process when we create a pressure differential of 0.25-0.5 bar between the vessel and the gas cylinder in order to force clarification agent into the beverage. This is described in Appendices 5 and 8.

WHEN TO COOL THE CIDER

The cider should be at 1.008 by Day 7 and we recommend putting the cooling on then. Once the cider is cold by Day 7.5 the yeast should have stopped and the cider should be clear and ready to consume.

However, we recommend you determine when to put the cooling on by the actual S.G. measurement rather than the day. If you ferment the cider all the way to 1.000 or lower, you may find the cider to be too thin, dry and tart (sour), which is why we suggest to put the cooling on before it is fermented right out. The yeast will settle and leave a clear cider, so do not add any clarification agent as this is not required.

COOLING AND BEVERAGE CLARITY

To a certain extent, the cooling helps some of the remaining yeast in the beverage to settle down into the sediment bottle, but the yeast mostly flocculates when it has finished consuming the sugars that it can consume.

However you should notice the layer above the sedimented yeast to be a bit more settled after cooling compared to before the cooling is put on.

The cold temperatures also assists the clarification agent to combine not only with yeast to clear beer, but also with haze proteins from the barley that make beers hazy. The colder the beer the more of a reaction there will be between these proteins and the clarification agent, which helps make a brighter beer.

APPENDIX EIGHT: CLARIFYING THE BEVERAGE

Clarifying the beverage is important if you want to make a beverage that looks like most commercial mainstream and craft beers, ciders and meads. Some beverages styles are supposed to be cloudy (e.g. some wheat beers, some ciders) and it also a matter of personal preference whether you clear the beverage or not.

WHAT YOU ARE CLARIFYING

When you clarify with WilliamsWarn Clarification Agent, you are removing two types of haze. The first is yeast cells that make up most of the cloudiness and the second is (for beers, not fruit beverages) haze proteins from the barley used to make the extract.

The clarification agent binds with both these components and settles into the sediment bottle under the vessel valve. We can then close the valve and remove this sediment at the right moment and are left with a clear beverage in the vessel.

REMOVING THE NATURALLY SEDIMENT YEAST FIRST

After fermentation and once the beverage is at the dispense temperature (cooled), we are ready to clarify the beverage. There will be an amount of naturally sedimented yeast in the sediment bottle. It is possible to clarify a new sediment layer onto this naturally sedimented yeast, however we find that there is an undesirable reaction between the two that slows down the clarification process.

So our preferred method is to remove the naturally sediment layer first to avoid these reactions. There will be some loss of beverage depending on the yeast used, as not all the contents of the sediment bottle will be yeast, but in all breweries there is some “losses” in order to make a great beverage, so a small amount of beverage loss is typical of the brewing process.

So for this reason we first remove the sediment bottle once the beverage is cold and dump the naturally sedimented yeast.

PREVENTING OXIDATION

Once we have dumped the naturally sedimented yeast we need to put the sediment bottle back on to catch the sediment that will settle when we mix the clarification agent into the beverage. However we do not want any oxygen to go into the beverage. There are several ways to reduce air in the empty bottle. You can add beer (from the bottom of the bottle) from the draft tap, beverage foam (full of carbon dioxide) from the draft tap or add carbon dioxide gas from the gas cylinder and purge the air out.

We prefer to add beverage foam from the draft tap. Beer foam especially is very stable as it has foam proteins and hops components, along with carbon dioxide, that keeps it in formation for a period of time. We therefore fill the bottle with foam before we put the bottle back on, to displace the air in the bottle.

The foam is mainly carbon dioxide and contains no air so as it fills the sediment bottle it will displace all air out of the bottle. Fill it right to the top and even have some foam extending out the top, to reduce adding any oxygen to the tank when you reconnect the sediment bottle to the tank and open the valve.

This foaming is achieved by pushing the draft tap handle towards the back of the unit, which is the foam mechanism of the draft tap.

Technically there will be some very slight addition of oxygen to the beverage at a parts per billion level, but it will not be significant and will be absorbed by the yeast still in the beverage. Oxidation is more pronounced after yeast is removed from the beverage, which occurs when breweries pump filtered beer around a brewery and when they package the clarified beer.

FORCING CLARIFICATION INTO THE BEVERAGE

Getting a good mixing of the clarification agent into the beverage is critical. We do this by creating a pressure differential between the vessel and the gas cylinder of 0.25 to 0.5 bar, whereby the gas cylinder has the higher pressure. We then have the agent in the clarification pot and open the 3-way valve on the tower which then connects the gas cylinder to the pot and forces the agent into the beverage through a one-way valve under the pot.

If the gas cylinder is 0.25 bar higher than the tank you will achieve adequate mixing over 10 seconds, enough to clarify the beverage. The bubbling that will be heard in the tank would be termed “vigorous”.

However a pressure differential of 0.5 bar will create “very vigorous bubbling” and that is why for beginners we suggest this differential, to ensure clarification is achieved well in the very first brew.

When you clarify for the first time it is important to hear the bubbling in the tank so you can assess the amount of bubbling and therefore mixing required for good clarification.

THE METHOD FOR BEGINNERS

The method we have described in the main instructions is for well carbonated beverages and first-time users. We ferment at a higher level of carbonation than we will want in the final beer

(since the yeast is making excess carbon dioxide for free) and then release pressure out of the vessel by depressing the button on the VPRV to have the vessel at 0.5 bar lower pressure than the gas cylinder. We then open the 3-way valve and the pressure differential forces the clarification agent in the pot into the beverage. We mix for 10 seconds. We then rinse the pot and force that into the beverage to clear the line and wait 1 day.

We repeat this again and wait 1 ½ days before removing the sediment bottle and then consuming the beverage.

Once you have experienced creating this pressure differential and have heard what we term as "vigorous bubbling" and successfully cleared beers, you may like to try the method described below for experienced brewers.

THE METHOD FOR EXPERIENCED BREWERS

In this method you do not rely on setting an exact pressure differential before opening the 3-way valve but rather open the 3-way valve first and then release gas out of the vessel quickly to create the pressure differential.

Once the pressure differential is made, the mixing will begin.

What you then control to is the vigorous bubbling sound in the tank rather than an exact pressure differential. For that reason we suggest it for experienced brewers who know what is expected. The term "vigorous" is subjective and different people will have a different idea of what vigorous bubbling is. However once it is experienced by a set pressure differential, this bubbling sound, rather than the pressure differential, can be used to control clarification for those who would like to.

In this method, when the beverage in the tank is for example at 1.25-1.5 bar after cooling and the gas cylinder at 1.25 bar (the settings recommended in the main instructions for first-time brewers) you put the agent in the pot and then turn the 3-way to the pot. No agent will mix into the beer yet as the pressure of the tank is still higher than the gas cylinder.

Then, to mix the agent in, you simply de-press the button on the VPRV to release gas out of the tank. You can either watch the tank pressure gauge reduce or you can perform this "blind" and rely on the sound of the mixing.

If you prefer to watch the vessel pressure gauge, de-press the VPRV release button and achieve a reduction in pressure 0.5 lower than that of the gas cylinder. In this case you'd reduce the tank to 0.75 bar. As soon as enough differential is made, you will hear the mixing begin because the 3-way is already open.

However it is possible to perform this without really knowing what the pressure in the cylinder or the vessel actually are. In this "blind" method, you will reply on you sense of hearing and touch. You simply release pressure in the tank until you hear bubbling that is required to get the mixing you know is adequate to get a good clarification. You can also place your hand on the vessel lid to feel the bubbling to ensure it is vigorous.

If the initial mixing doesn't sound vigorous enough, you just release more pressure until the bubbling is vigorous and count the 10 seconds.

This can work well for experienced brewers but you will in essence be creating a slightly different pressure differential each time. This is okay as any differential over 0.25 bar or thereabouts will create enough mixing.

However for beginners we need to ensure all first-time users are creating the identical pressure differential each time until it is learnt what bubbling amount is required. Therefore in the main instructions we first create a set differential and then turn the 3-way only after that is set. This method is the other way around in that the 3-way is first opened and then the pressure differential is created.

But like most of the steps in our instructions, there are always alternative methods that can be used and you are welcome to try any method that results in a clear beverage.

THE METHOD FOR LOW CARBONATED BEERS

When you brew beers at a very low carbonation level, another technique is required. This is because the pressure is so low, we cannot release gas from the vessel via the VPRV lower than atmospheric pressure (0 bar) and so the first two methods described above cannot work. For example, if you're making an English Ale at 5°C and want a carbon dioxide content of 3 g/l, you only need 0.12 bar pressure in the vessel, which is very low. So you cannot release 0.25-0.5 bar out of the vessel as described in the first method when making well carbonated beers.

In this case you need to brew with the VPRV set at about 0.25 bar above the level of carbonation you want (to allow for the drop in pressure when the cooling is put on) and set the gas cylinder at 0.25-0.5 bar above that (to create the pressure differential). Then clarify as per normal and the gas bottle pressure will force the clarification agent in the beer. The pressure will increase in the vessel and it may release itself out of the VPRV. When you've finished clarifying, you then should release pressure out of the VPRV to the level you want in the final beer.

You will clarify a second time using the same principle. Once you have finished the second clarification, release the increased gas in the vessel again to the pressure (and therefore carbonation level) you want. Then wind the VPRV down to its closed position (clockwise). Then after this, you will finally set the gas cylinder at the same pressure which is your chosen dispense pressure, and open the 3-way valve to the vessel. When you dump the sediment bottle after 36 hours the beverage will be at the correct pressure and carbonation.

The difference with this method is that you cannot set the gas cylinder at the pressure you want in the final beer during dispense until after you have clarified. With higher carbonated beers as described in the first two methods above, you can set the gas cylinder pressure at the beginning of the process and not change it and use the VPRV to make the pressure differential by releasing pressure from the tank.

In either case the principle is the same in that a pressure differential of 0.25 -0.5 bar is required between the vessel (at the lower pressure) and the gas cylinder (at the higher pressure) in order to force the clarification agent in when the 3-way valve is opened to the clarification pot.

RINSING THE POT

It is important to rinse the pot after each clarification and also bubble that into the beverage in order to clear the line of clarification agent.

The clarification agent can form little solid lumps if left over time and this can get stuck in the one-way valve under the pot.

So you MUST rinse the line each time.

Otherwise beverage will start to come back up the pot and create problems.

You need to hear the bubbling for only 1 second as that means all the water has been rinsed through the one-way valve and the clarification line and into the beverage.

If it does block and beverage is seen filling the pot over time, the panel can be taken off the tower and the one-way removed, as long as the vessel isn't under pressure. The solids can be rinsed, blown or tapped out and the one-way put back.

To remove the one-way valve you need to push the push lock fitting while pulling the tubing out. You must ensure the lines are pushed hard back into the ends of the one-way valve when you replace it. You must also ensure the one-way is put back on in the correct direction so fluid can flow from pot to vessel.

DIFFICULT YEAST

Some yeast are very difficult to clear and may require extra clarification. In this case you should add another 30-50ml of agent and try a 3rd mixing.

The yeast we are using all clear very easily except for T-58 which can sometimes be stubborn. However Belgian Ales can be a little hazy and still true to style so if T-58 doesn't quite clear to what you experience with the other yeast, perhaps enjoy it a little hazier than you would the other beers.

Other yeast bought through other suppliers may of course be used in a WilliamsWarn and you will need to see how they react to our agent. We'd assume 80% of brewing yeasts will clear.

You can also try other finings agents through the pot if our agent doesn't seem to work for the beer you are making.

IMPORTANT SAFETY INSTRUCTION

Only use liquids in the clarification pot. The use of solids or liquids with particles may cause blockage or fault in the one-way valve that is under the clarification pot.

APPENDIX NINE: DISPENSING THE BEVERAGE

THE DRAFT TAP

The draft tap opens by pulling the handle towards you. There is a flow control lever on the side which when pushed fully up is closed and when pushed fully down is 100% open. If the flow control lever is closed (pushed up) when you open the draft tap there will be no flow. If you then slowly press the flow control lever down, you will see the beverage pour.

For the first pour of the day, we recommend having the flow controller closed when you open the tap, and then slowly open the controller. This is because the beverage in the line will be warm and the first pour will foam a little.

When cold beverage is coming through (after about 40ml is poured) you can open the flow controller more to have a faster fill.

The draft tap also has a foaming mechanism. To add foam after filling a glass, push the draft tap handle away from you, and foam will pour out of the tap.

SAFETY

For safety reasons and to avoid loss of beverage, we recommend to always have the flow control lever push up (closed) when you are not consuming the beverage. This is in case the tap accidently is opened (by a guest or child for example) or if the tap becomes sticky and doesn't close properly.

THE LIGHT

You can press the vessel light button on the front of the tower and look through the vessel sightless to view the contents and see how much beverage remains, as you consume your creation.

WHEN THE VESSEL IS EMPTY

When the last beverage is poured, simply turn off the power to the Personal Brewery but leave it under pressure to avoid contamination.

When you want to make another beverage, start at Stage 1 again in the main instructions.

If you are going to leave the brewery for an extended period of time, it is best to clean it after the last use and then let it sit idle (with the lid closed).

CLEANING THE DRAFT TAP

The draft tap may periodically need to be taken off the tower and disassembled and given a hand-clean. This will be required if you find the draft tap is sticking when being operated or if you see any growth coming out the front of the tap.

To disassemble the tap, ensure there is no pressure in the vessel and ideally the vessel should be empty. Unscrew the tap from the tap tower first and then unscrew the flow controller and unscrew the front screw.

The parts can be removed easily.

You can clean the parts in WilliamsWarn Brewery Detergent or a similar chemical and sterilise in hot water at 80°C/176°F.

Re-assemble in the same manner.

APPENDIX TEN:
DESCRIPTIONS OF OUR STANDARD KITS & THE BJCP STYLE GUIDELINES

THE WILLIAMSWARN STANDARD KITS

As of the writing of this manual WilliamsWarn has 15 Standard Kits of differing beer styles. See Figure 68.

Each of these cans is designed to be used with a 1kg foil bag of WilliamsWarn Dry Malt Extract (DME), as shown in Figure 69, except for the Cider which is designed to be used with a second can of Cider as shown in Figure 70.

The reason the cans are sold separate to the DME is to give the brewer the option to cheapen the cost of the brew by using dextrose (glucose) sugar instead, or "Enhancer" or "Booster" type products that are a mixture of dextrose, DME and sometimes malto-dextrin to give body. This is the system currently employed in the homebrew community. It gives the brewer some flexibility on half the ingredients.

For the beer LME cans, all the malt colour and hop bitterness you need for the 23 Litre (5 UK Gallons/6 US Gallons) brew is within the can, so you can chose from a few options for the second pack of ingredients you may use. This second part is very necessary however, to ensure the right amount of sugars are in the wort to get to the alcohol content you desire.

You should never therefore use 2 cans of beer kits as the bitterness and colour will be double the intended specification.

Our recommendation however is to just use our WilliamsWarn DME as the second part of the ingredients for beer kits, as too much sugar makes a very poor tasting beer. It's acceptable to use a little bit of sugar, up to 20% of the ingredients by weight (LME is 80% extract by weight remember, the rest water), but above this the yeast starts to produce a lower quality beer. Our DME is also the best in the world by far (it is supplied to us from an American company who make it in a modern state-of-the art brewhouse from US and Canadian 2-row barley).

For the Cider you can use sugar but the apple flavour will obviously be much lower, so we suggest you use the two cans to get a better tasting cider made from 100% apple juice.

So on our website and with our distributers in the future in different countries, we offer the single cans as well as the complete kits for you to purchase.

Under each can lid is a premium dried yeast from either Fermentis or Lallemand, so you know what you are using for

Fig. 68

Fig. 69

Fig. 70

each beer style and the thinking behind each yeast type used. The cider is SC22 yeast from Fermentis re-packaged from bulk into a 7g sachet.

THE BJCP STYLE GUIDELINES

The craft beer and homebrew revolution in the USA is the best thing to happen in the brewing world in the last century. As part of this revolution some of the brewers got together and developed style guidelines so that there were some agreed standards brewers could use when making certain beer styles. There are several guidelines published but we have used The BJCP Style Guidelines as a basis for our beer styles in our Standard Kits.

We recommend you download the full PDF of these guidelines so that you become familiar with the list of agreed beer styles and the specification for these. This PDF can be found at http://www.bjcp.org/stylecenter.php. The complete list of beverages that can be found in the BJCP guidelines is displayed below for your reference.

BJCP BEVERAGE STYLE GUIDE

1. LIGHT LAGER
- 1A. Lite American Lager
- 1B. Standard American Lager
- 1C. Premium American Lager
- 1D. Munich Helles
- 1E. Dortmunder Export

2. PILSNER
- 2A. German Pilsner (Pils)
- 2B. Bohemian Pilsener
- 2C. Classic American Pilsner

3. EUROPEAN AMBER LAGER
- 3A. Vienna Lager
- 3B. Oktoberfest/Märzen

4. DARK LAGER
- 4A. Dark American Lager
- 4B. Munich Dunkel
- 4C. Schwarzbier (Black Beer)

5. BOCK
- 5A. Maibock/Helles Bock
- 5B. Traditional Bock
- 5C. Doppelbock
- 5D. Eisbock

6. LIGHT HYBRID BEER
- 6A. Cream Ale
- 6B. Blonde Ale
- 6C. Kölsch
- 6D. American Wheat or Rye Beer

7. AMBER HYBRID BEER
- 7A. Northern German Altbier
- 7B. California Common Beer
- 7C. Düsseldorf Altbier

8. ENGLISH PALE ALE
- 8A. Standard/Ordinary Bitter
- 8B. Special/Best/Premium Bitter
- 8C. Extra Special/Strong Bitter (English Pale Ale)

9. SCOTTISH AND IRISH ALE
- 9A. Scottish Light 60/-
- 9B. Scottish Heavy 70/-
- 9C. Scottish Export 80/-
- 9D. Irish Red Ale
- 9E. Strong Scotch Ale

10. AMERICAN ALE
- 10A. American Pale Ale
- 10B. American Amber Ale
- 10C. American Brown Ale

11. ENGLISH BROWN ALE
- 11A. Mild
- 11B. Southern English Brown
- 11C. Northern English Brown Ale

12. PORTER
- 12A. Brown Porter
- 12B. Robust Porter
- 12C. Baltic Porter

13. STOUT
- 13A. Dry Stout
- 13B. Sweet Stout
- 13C. Oatmeal Stout
- 13D. Foreign Extra Stout
- 13E. American Stout
- 13F. Russian Imperial Stout

14. INDIA PALE ALE (IPA)
- 14A. English IPA
- 14B. American IPA
- 14C. Imperial IPA

15. GERMAN WHEAT AND RYE BEER
- 15A. Weizen/Weissbier
- 15B. Dunkelweizen
- 15C. Weizenbock
- 15D. Roggenbier (German Rye Beer)

16. BELGIAN AND FRENCH ALE
- 16A. Witbier
- 16B. Belgian Pale Ale
- 16C. Saison
- 16D. Bière de Garde
- 16E. Belgian Specialty Ale

17. SOUR ALE
- 17A. Berliner Weisse
- 17B. Flanders Red Ale
- 17C. Flanders Brown Ale/Oud Bruin
- 17D. Straight (Unblended) Lambic
- 17E. Gueuze
- 17F. Fruit Lambic

18. BELGIAN STRONG ALE
- 18A. Belgian Blond Ale
- 18B. Belgian Dubbel
- 18C. Belgian Tripel
- 18D. Belgian Golden Strong Ale
- 18E. Belgian Dark Strong Ale

19. STRONG ALE
- 19A. Old Ale
- 19B. English Barleywine
- 19C. American Barleywine

20. FRUIT BEER

21. SPICE/HERB/VEGETABLE BEER
- 21A. Spice, Herb, or Vegetable Beer
- 21B. Christmas/Winter Specialty Spiced Beer

22. SMOKE-FLAVORED/ WOOD-AGED BEER
- 22A. Classic Rauchbier
- 22B. Other Smoked Beer
- 22C. Wood-Aged Beer

23. SPECIALTY BEER

24. TRADITIONAL MEAD
- 24A. Dry Mead
- 24B. Semi-sweet Mead
- 24C. Sweet Mead

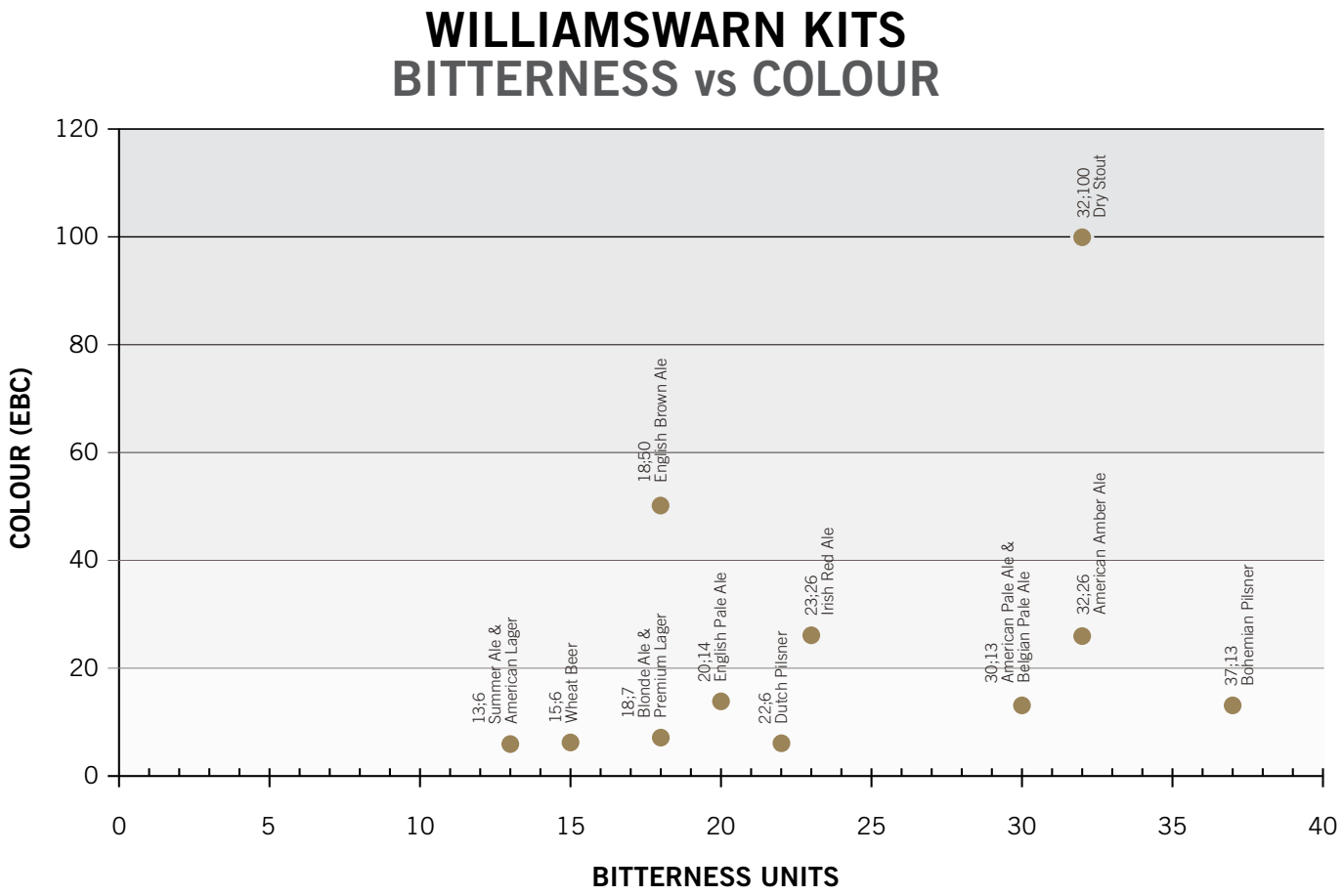
25. MELOMEL (FRUIT MEAD)
- 25A. Cyser
- 25B. Pyment
- 25C. Other Fruit Melomel

26. OTHER MEAD
- 26A. Metheglin
- 26B. Braggot
- 26C. Open Category Mead

27. STANDARD CIDER AND PERRY
- 27A. Common Cider
- 27B. English Cider
- 27C. French Cider
- 27D. Common Perry
- 27E. Traditional Perry

28. SPECIALTY CIDER AND PERRY
- 28A. New England Cider
- 28B. Fruit Cider
- 28C. Applewine
- 28D. Other Specialty Cider/Perry

All our WilliamsWarn Standard Kits have been developed to match styles as closely as possible to these guidelines. We have especially focused on matching colour and bitterness. A summary of WilliamsWarn Kits colour vs bitterness is shown on Chart 1 below.



In some cases we are very slightly out of the BJCP spec for either colour or bitterness but that is because we're choosing our own specification for technical or historical reasons.

In some cases we are also slightly lower in alcohol content than the spec, because we have standardised our kits as one can of LME and one 1kg (2.2 lbs) foil bag of DME to keep it simple and consistent. However as explained in Appendix 3, you can very easily increase the alcohol content of a Standard Kit by adding 250g to 500g of DME or dextrose (glucose) when you add the ingredients to a brew.

It is acceptable to add this extra as dextrose (glucose) as the base kit has so many good nutrients for the yeast that a little pure sugar is not an issue. So feel free to boost the alcohol a little with dextrose as it is cheaper than DME and won't impact on quality if a 1kg bag of DME is already part of the ingredients you use.

However be aware that German beers are traditionally made with 100% malted barley so it is better to boost the alcohol content of these with DME only and not any sugar.

THE ADVANCED METHOD

From these Standard Kits you can add extra malt and hops and make other beer styles via what we call our Advanced Method. This is what is known in the USA as "Extract plus Grains". That name is a little misleading as it is in fact a method using malt extract plus not only grains but hops and any other ingredient you want.

The method of soaking extra crushed malt and hops is described in Part 3. Advanced recipes to allow you to expand into other beer styles while using the Standard Kits as a base are available on our website in 2013.

DESCRIPTIONS OF OUR STANDARD KITS

AMERICAN AMBER ALE
A bitter beer with full-bodied, speciality malt character.

Our American Amber Ale has a deep-amber, light-copper appearance from crystal and black malts included in the recipe. These give this beer caramel, raisin and biscuity notes with a slightly dry finish. The hops provide a prominent level of bitterness to balance the malt flavours.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 32 Bitterness Units and 13 SRM/26 EBC colour.

Ferment at 23°C/73°F.

To elevate the fresh hop aroma of this style, we recommend the brewer make a hop tea of 1-2 oz. (28-56g) of any American hops in a French coffee press. Add approx. 900ml of hot boiled water to the hops, stir and then steep for 20 minutes. Plunge the solids and add the green, filtered hop tea to the mix of ingredients in your fermenter (before adding the yeast). Download the WilliamsWarn User Manual from our website for more details.

AMERICAN LAGER
A refreshing American Lager for those who appreciate one of the world's most popular beer styles.

Our American Lager is straw-coloured in appearance with a low bitterness. It is crisp, dry and thirst-stopping. The lager yeast employed will give some slightly fruity notes to add a pinch of character. The goal is a light-tasting beer with low levels of malt, hop and yeast character in perfect balance.

The yeast under the lid is an 11.5g pack of Fermentis S-23 lager yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.009 (2.3°P), resulting in 4.1-5.2% alcohol by volume, 13 Bitterness Units and 3 SRM/6 EBC colour.

Ferment at 15°C/59°F.

AMERICAN PALE ALE
A flavourful American Pale Ale.

Our American Pale Ale has an amber appearance with a prominent bitterness. Due to ale and crystal malts used, it has a steady malt flavour with a touch of bready and toasty notes.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 30 Bitterness Units and 6.5 SRM/13 EBC colour.

Ferment at 23°C/73°F.

To elevate the fresh hop aroma of this style, we recommend the brewer make a hop tea of 1-2 oz. (28-56g) of any American hops in a French coffee press. Add approx. 900ml of hot boiled water to the hops, stir and then steep for 20 minutes. Plunge the solids and add the green, filtered hop tea to the mix of ingredients in your fermenter (before adding the yeast). Download the WilliamsWarn User Manual from our website for more details.

BELGIAN PALE ALE
A flavoursome Belgian Pale Ale.

Our Belgian Pale Ale has an amber colour and a decent bitterness. From ale and crystal malts used in the grain bill, it has a solid malty and slightly bready taste. The yeast employed is a true Belgian Ale yeast that will give banana, spicy and peppery attributes to the beer.

The yeast under the lid is an 11.5g pack of Fermentis T-58 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.012 (3.0°P), resulting in 3.75-4.8% alcohol by volume, 30 Bitterness Units and 6.5 SRM/13 EBC colour.

Ferment at 23°C/73°F.

BLONDE ALE
A refreshing, easy-drinking Blonde Ale with a crisp palate.

Our Blonde Ale is yellow in appearance with a moderate bitterness. It sits in the Hybrid category of the BJCP Style Guidelines and is an ale version of a lager beer. It therefore ferments warm (23°C/73°F) with great efficiency with our ale yeast, but with the resulting taste profile being similar to that of a light lager.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 18 Bitterness Units and 3.5 SRM/7 EBC colour.

Ferment at 23°C/73°F.

BOHEMIAN PILSNER
A traditional Bohemian Pilsner with a rich, complex maltiness and a crisp finish.

Our Bohemian Pilsner is deep gold in appearance with a high bitterness and long lasting creamy head. The yeast employed is a classic German Pilsner yeast that leaves a very clean taste.

The yeast under the lid is an 11.5g pack of Fermentis W34/70 lager yeast, the most famous and most widespread German lager yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.009 (2.3°P), resulting in 4.1-5.2% alcohol by volume, 37 Bitterness Units and 6 SRM/12 EBC colour.

Ferment at 15°C/59°F for 3 days and then increase to 18°C/64°F for a diacetyl rest to complete fermentation after another 3 days. Cooling can be put on at Day 6 when SG should be about 1.009.

As an option, hop aroma and taste can be elevated if the brewer makes a hop tea of 1-2 oz. (28-56g) of any Czech (or German) hops in a French coffee press. Add approx. 900ml of hot boiled water to the hops, stir and then steep for 20 minutes. Plunge the solids and add the green, filtered hop tea to the mix of ingredients in your fermenter (before adding the yeast). Download the WilliamsWarn User Manual from our website for more details.

DRY APPLE CIDER

A pleasant and appealing Cider.

Our Apple Cider is made from the highest quality apples. The result is a very dry, clean and crisp cider. The apple flavours are light and pleasant and the overall taste is refreshing.

The yeast under the lid is a 7g pack of Fermentis cider yeast.

This product is designed to be used with a second 1.65kg/3.6lbs can of WilliamsWarn Dry Cider to make 23 Litres of juice (5 Imperial gal/6 US gal) which should then be pitched with 1 packet of Cider yeast (7g). Alternatively you can pitch both sachets for a faster fermentation.

Original Gravity: 1.036 (9°P). Final Gravity: 1.000 (0°P) or just under. Alcohol by Volume: 5.0%.

Ferment at 23°C/73°F.

Alternatively you can also use 1kg of dextrose with one can to make a very light tasting cider.

If you would like to produce a slightly sweeter cider for body and to balance the natural acidity, put the cooling on your fermenter to at least 4°C (39°F) when the Specific Gravity reads 1.006 or just above that. This will stop fermentation and lead to a fuller tasting cider with an alcohol content of about 4% by volume.

DRY STOUT

A true Dry Stout with a compelling personality.

Our Dry Stout has a black appearance from the crystal malts, roasted malts and roasted barley employed in the grain mix. The result is a great Dry Stout that has liquorice, roasted coffee and chocolate flavours dominating. The prominent hop bitterness level helps elevate the dryness, which comes from the roasted un-malted barley used.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 32 Bitterness Units and 50 SRM/100 EBC colour.

Ferment at 23°C/73°F.

DUTCH PILSNER

This is a noble brew with a crisp finish.

Our Dutch Pilsner is straw-coloured in appearance with a moderate, lingering bitterness. The yeast employed is a classic strain that leaves a slightly estery aroma that is typical of Pilsners from The Netherlands. When used with our light DME to make an all-malt beer, the combination of ingredients makes a Pilsner very true to the region.

The yeast under the lid is an 11.5g pack of Fermentis S-23 lager yeast which is commonly used by large breweries in Western Europe.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.009 (2.3°P), resulting in 4.1-5.2% alcohol by volume, 22 Bitterness Units and 3 SRM/6 EBC colour.

Ferment at 15°C/59°F for 3 days and then increase to 18°C/64°F for a diacetyl rest to complete fermentation after another 3 days. Cooling can be put on at Day 6 when SG should be about 1.009.

ENGLISH BROWN ALE

An authentic Brown Ale with a dark-fruit character.

Our English Brown Ale has a dark brown appearance from a range of speciality malts employed in the recipe. The resulting beer has an array of flavours that includes raisins, plums, figs, nuts, biscuits, caramel and toffee, that last into the finish. The hops provide a moderate level of bitterness that helps balance the dark-fruit malt flavours.

The yeast under the lid is an 11g pack of Lallemand Nottingham Ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.010 (2.5°P), resulting in 4.0-5.1% alcohol by volume, 18 Bitterness Units and 25 SRM/50 EBC colour.

Ferment at 23°C/73°F.

ENGLISH PALE ALE

A full-bodied English Pale Ale.

Our English Pale Ale has an amber appearance with a moderate bitterness. Technically, within the BJCP Style Guidelines it is a Standard Bitter – the lightest of the English bitter types with respect to alcohol content, colour and bitterness. This beer has a firm malty start, a touch of fruitiness from the yeast and a long dry finish from the hops.

The yeast under the lid is an 11g pack of Lallemand Nottingham Ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.010 (2.5°P), resulting in 4.0-5.1% alcohol by volume, 20 Bitterness Units and 7 SRM/14 EBC colour.

Ferment at 23°C/73°F.

IRISH RED ALE

An easy drinking pint.

Our Irish Red Ale has a deep-amber, light-copper appearance from crystal and black malts included in the recipe. The malt focus gives this beer caramel, toffee and toasty notes and a slight dry, roasted-grain finish. The hops provide a moderate level of bitterness. Overall, this is an interesting beer that is a pleasure to produce and appreciate.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 23 Bitterness Units and 13 SRM/26 EBC colour.

Ferment at 23°C/73°F.

PREMIUM LAGER

A pleasant Premium Lager with a clean taste profile.

Our Premium Lager is yellow in appearance with a moderate bitterness. It is a satisfying beer that sits in between American Lagers and European Pilsners in character. The yeast employed will ferment clean and true-to-style. An agreeable drop that's ideal for brewing for social events and therefore to be shown-off to your friends.

The yeast under the lid is an 11.5g pack of Fermentis W34/70 lager yeast, the most famous and most widespread German lager yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.009 (2.3°P), resulting in 4.1-5.2% alcohol by volume, 18 Bitterness Units and 3.5 SRM/7 EBC colour.

Ferment at 15°C/59°F for 3 days and then increase to 18°C/64°F for a diacetyl rest to complete fermentation after another 3 days. Cooling can be put on at Day 6 when SG should be about 1.009.

SUMMER ALE

A thirst-quenching Summer Ale, perfect for the hot summer months.

Our Summer Ale is straw-coloured in appearance with a low bitterness. Technically it is regarded as a Cream Ale – an ale version of a lager beer. It therefore ferments warm (23°C/73°F) with great efficiency with our ale yeast, but with the resulting taste profile being similar to that of a light lager.

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P- 12°P), fermented to a Final Gravity of about 1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 13 Bitterness Units and 3 SRM/6 EBC colour.

Ferment at 23°C/73°F.

WHEAT BEER

A refreshing, smooth-drinking Wheat Beer.

Our Wheat Beer has a straw-coloured appearance with a low bitterness. The malted wheat in the grain bill gives this beer a slightly grainy flavour with a creamy fullness that leads to a light finish. The yeast employed will provide only low levels of phenolic flavours and so this brew leans towards a fresh, American wheat beer in style (rather than the clove-tasting European wheat beers).

The yeast under the lid is an 11.5g pack of Fermentis S-33 ale yeast.

This product is designed to be used with 1.0-1.5 kg (2.2-3.3lbs) of WilliamsWarn Light Dry Malt Extract (or alternatively a wheat-based extract) and water to make 23 Litres (6 US Gallons/5 Imp. Gallons) of wort. Original Gravity of 1.040-1.048 (10°P-12°P), fermented to a Final Gravity of about

1.013 (3.3°P), resulting in 3.6-4.7% alcohol by volume, 15 Bitterness Units and 3 SRM/6 EBC colour.

Ferment at 23°C/73°F.

APPENDIX ELEVEN: CONVERSION TABLES

TEMPERATURE

CELSIUS (°C)	FAHRENHEIT (°F)
1	33.8
2	35.6
3	37.4
4	39.2
5	41.0
6	42.8
7	44.6
8	46.4
9	48.2
10	50.0
11	51.8
12	53.6
13	55.4
14	57.2
15	59.0
16	60.8
17	62.6
18	64.4
19	66.2
20	68.0
21	69.8
22	71.6
23	73.4
24	75.2
25	77.0
26	78.8
27	80.6
28	82.4
29	84.2
30	86.0
31	87.8
32	89.6
33	91.4
34	93.2

CELSIUS (°C)	FAHRENHEIT (°F)
35	95.0
36	96.8
37	98.6
38	100.4
39	102.2
40	104.0
41	105.8
42	107.6
43	109.4
44	111.2
45	113.0
46	114.8
47	116.6
48	118.4
49	120.2
50	122.0
51	123.8
52	125.6
53	127.4
54	129.2
55	131.0
56	132.8
57	134.6
58	136.4
59	138.2
60	140.0
61	141.8
62	143.6
63	145.4
64	147.2
65	149.0
66	150.8
67	152.6
68	154.4

CELSIUS (°C)	FAHRENHEIT (°F)
69	156.2
70	158.0
71	159.8
72	161.6
73	163.4
74	165.2
75	167.0
76	168.8
77	170.6
78	172.4
79	174.2
80	176.0
81	177.8
82	179.6
83	181.4
84	183.2
85	185.0
86	186.8
87	188.6
88	190.4
89	192.2
90	194.0
91	195.8
92	197.6
93	199.4
94	201.2
95	203.0
96	204.8
97	206.6
98	208.4
99	210.2
100	212.0

VOLUME

LITRE (L)	US FLUID OUNCE (FL. oz.)	US PINT (pt)	US GALLONS
0.25	8.45	0.53	0.07
0.50	16.90	1.06	0.13
0.75	25.36	1.58	0.20
1.00	33.81	2.11	0.26
1.25	42.27	2.64	0.33
1.50	50.72	3.17	0.40
1.75	59.17	3.70	0.46
2.00	67.63	4.23	0.53
2.50	84.54	5.28	0.66
3.80	128.49	8.03	1.00

WEIGHT

KILOGRAM (kg)	OUNCE (oz)	POUND (lb)
0.25	8.80	0.55
0.50	17.60	1.10
0.75	26.50	1.65
1.00	35.30	2.20
1.25	44.10	2.76
1.50	52.90	3.31
1.75	61.70	3.86
2.00	70.50	4.41
2.50	88.20	5.51
3.00	105.80	6.61

PRESSURE

PSI	BAR
0.50	0.03
1.00	0.07
1.50	0.10
2.00	0.14
2.50	0.17
3.00	0.21
3.50	0.24
4.00	0.28
4.50	0.31
5.00	0.34
5.50	0.38
6.00	0.41
6.50	0.45
7.00	0.48
7.50	0.52
8.00	0.55
8.50	0.59
9.00	0.62
9.50	0.66
10.00	0.69

PSI	BAR
10.50	0.72
11.00	0.76
11.50	0.79
12.00	0.83
12.50	0.86
13.00	0.90
13.50	0.93
14.00	0.97
14.50	1.00
15.00	1.03
15.50	1.07
16.00	1.10
16.50	1.14
17.00	1.17
17.50	1.21
18.00	1.24
18.50	1.28
19.00	1.31
19.50	1.34
20.00	1.38

PSI	BAR
20.50	1.41
21.00	1.45
21.50	1.48
22.00	1.52
22.50	1.55
23.00	1.59
23.50	1.62
24.00	1.66
24.50	1.69
25.00	1.72
25.50	1.76
26.00	1.79
26.50	1.83
27.00	1.86
27.50	1.90
28.00	1.93
28.50	1.97
29.00	2.00

BREW RECORD SHEET

BEVERAGE STYLE / NAME	
BREW NUMBER	
START DATE AND TIME	

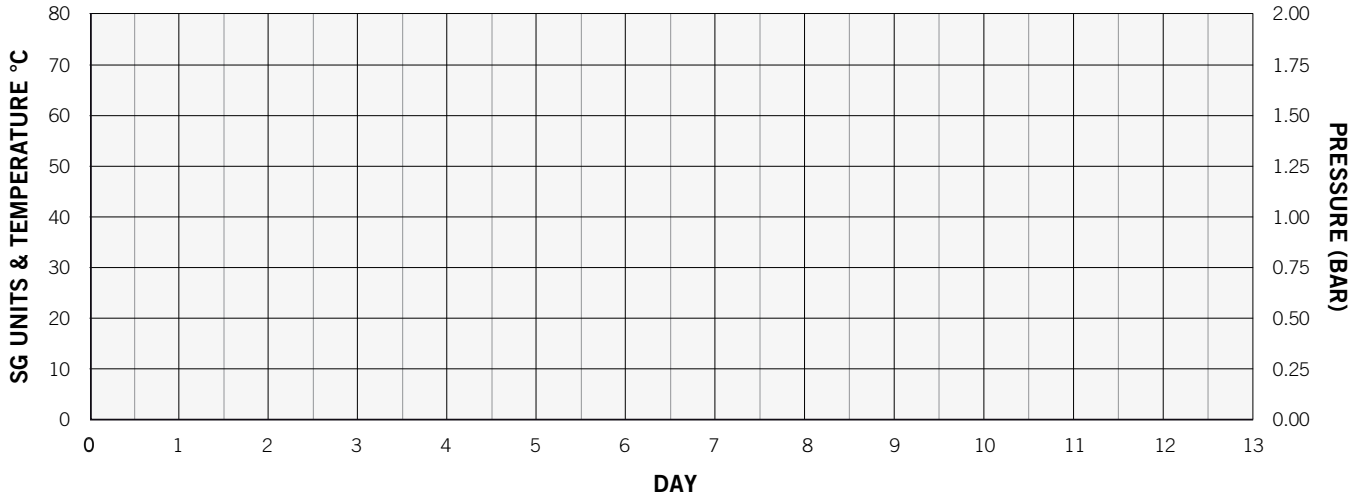
INGREDIENTS	
MALT EXTRACT	
WATER	
YEAST	
HOPS	
GRAINS	
SUGAR	
OTHER	

WORT/MUST PRODUCTION NOTES

FERMENTATION DATA					
DATE & TIME	DAY	S.G.	TEMP °C	PRESS.	NOTES

BREW RECORD SHEET

Fermentation Chart



CLARIFICATION

FINAL PRODUCT	
TASTE	
TASTE SCORE / 1-10 (SEE APPENDIX 12)	
CLARITY	
CARBONATION	
ALCOHOL %	

OTHER COMMENTS

APPENDIX TWELVE: TASTE TESTING

It is important to record a taste test score for each brew so that in the future you can refer to your records and see which beers are working best for you.

The best tasting system is blind taste testing, in which a series of beverages are presented and the taster has no knowledge of what the samples are. Then, in quiet conditions with absolutely no talking allowed, the taster/s smell and taste the samples and score them. Figure 72 is a photo of a typical taste test conducted in the garage in which the WilliamsWarn Personal Brewery was invented. In this case, one or two beers would be from a personal brewery and the rest were from the super-market. Similar types of beverages need to be compared and the tasters told, for example, that the beverages are "Lagers" or "Stouts" or "IPA's" so they know what to expect and to help score the beverages better.

The best point system to use as a scoring system for this is from 1 to 10, as described in the following Blind Taste Test Sheet. You can print this sheet from our manual on our website and use it for blind taste tests.

A score of 7 is like an anchor. It represents "Satisfactory". Beverages with no flavour should score a 7, as little or no flavour is acceptable and not the same as an off-flavour. In the following sheet, 7's are already inserted as the answers in order to have everyone start at the same point. From there tasters can adjust the score down for beverages with faults or up for beverages that are better than satisfactory.

To obtain a very accurate score a minimum of 6 tasters is required.

However, it is not practical to ask 6 people to come to your brewery each brew and for you to set up a blind taste testing. You can therefore ask someone living with you to set up 2-3 samples for you to blind test, with one of them being your own beer.

Alternatively, it may also be practical and necessary for you to score your beers knowing it's one of yours. In this case, take a sample and use the same scoring system and try to be as un-biased as possible. Record that score in the Brew Record sheet and our online database when it is on our website.

Don't be afraid to test your beers against commercial beers. You're making top quality beverages and you're sure to do well in blind taste testing if you get some friends around to participate.

Fig. 71

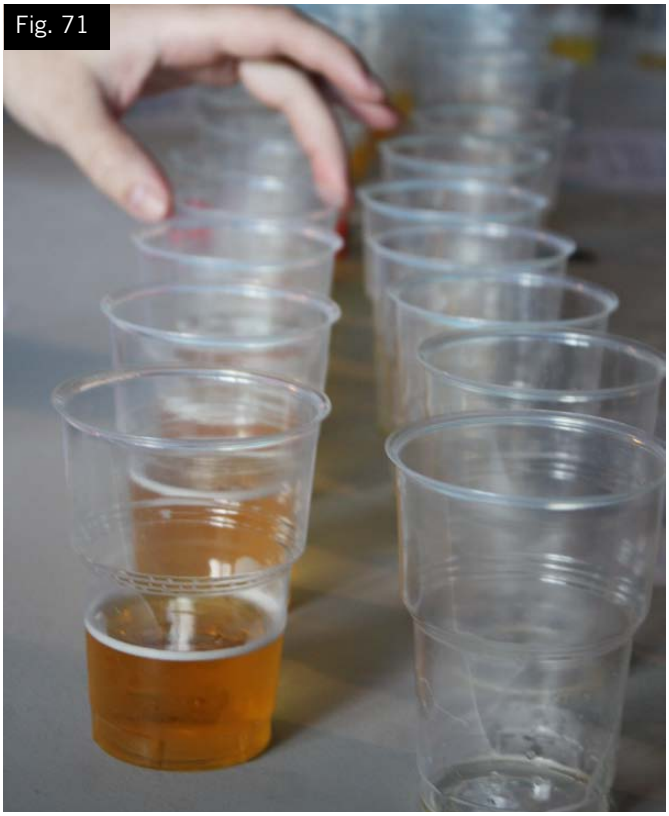


Fig. 72

BLIND TASTE TEST SHEET

Taste the beers in front of you and give them each an overall hedonic score from 1 to 10, as described in the box to the right.

The starting point is a score of 7 which is included in the score box already to anchor you. If the beer is "*Satisfactory*" in your opinion, leave the 7 in the box. Beers with no taste or beers that are bland are "*Satisfactory*" as they have no faults, so they should score 7's. Don't be afraid to leave all 7's if you think all are "*Satisfactory*". It's your opinion.

Beers you love and could drink all night or love the taste of are 8-10.

Beers with a few faults should score 5 or 6.

Beers with major issues are 1-4's.

SCORE GUIDE	
10	EXCEPTIONAL
9	VERY GOOD
8	GOOD
7	SATISFACTORY (NO OFF FLAVORS OR FAULTS, BLAND IS OK)
6	NOT QUITE SATISFACTORY (1 FAULT)
5	POOR (2 FAULTS)
4	BAD (SEVERAL FAULTS OR A MAJOR PROBLEM)
3	VERY BAD (WOULDN'T DRINK IT)
2	UNDRINKABLE (CAN'T DRINK IT)
1	WHAT THE HELL IS THIS LIQUID? DIESEL?

TEST SHEET			
NAME			
NUMBER	**SCORE 1-10**	**COMMENTS**	**BRAND**
1	7		
2	7		
3	7		
4	7		
5	7		
6	7		
7	7		
8	7		

WILLIAMSWARN

TROUBLE SHOOTING THE WILLIAMSWARN PERSONAL BREWERY

STAGE ONE:
CLEANING

PROBLEM 1:
I CAN'T REMOVE THE VESSEL LID

Solution:

Sometimes the vessel lid can be difficult to remove if the threads become bound together too tightly. In this case all that is needed is a little extra muscle from another person. So get help to unwind the lid counter-clockwise and you'll find the extra torque will allow the lid to be removed easily.

STAGE THREE:
DURING FERMENTATION

PROBLEM 1:
THE YEAST DOESN'T SEEM TO START FERMENTING

Solution:

Dried ale yeast should take ½ a day to show signs of fermenting and lager yeast about 1 day. If it takes longer than this then wait one more day for signs of activity. If by Day 2 there is no activity then it could be possible that the yeast had somehow died before use. If the yeast was rehydrated in water over 35°C (95°F) it may have been too hot. In general the dried brewing yeast WilliamsWarn uses is quite stable and should ferment even past its use by date unless the sachet has been broken and oxygen ingress has occurred or if it has been stored in very warm temperatures.

In the case of no activity after 2 days, close the vessel valve, remove the sediment bottle, dump the non-fermenting yeast which will likely be sedimented at the bottom and then rehydrate a new quality yeast in 25°C water (77°F) for 10 minutes. Add the sediment bottle back onto the brewery with the new quality yeast and open the valve in 2 stages, as described in the instructions (to avoid temperature shock). Monitor closely.

PROBLEM 2:
THE PRESSURE ISN'T BUILDING UP

Solutions:

1. Check that there is activity in the sediment bottle and foam seen on the beverage surface through the sight-glass and that the vessel valve is open. If fermentation is only just starting, the amount of carbon dioxide being generated is small and the pressure will take a while to build up. If fermentation is vigorous and the pressure is not building up over a few hours under such fermentation conditions, then you probably have a leak. Ale yeast should take ¾ of a day to start to build up pressure and lager yeast about 1 day. Firstly, release any pressure in the vessel via the VPRV by pressing the VPRV release button and remove the lid. Check the seal is sitting in the groove properly. It may need a stretch as explained in Appendix 4. Ensure the seal sits in the groove as shown in the photos in Appendix 4 and then re-close the lid tightly. Then monitor pressure build up. To speed up this test, you can manually add CO_2 from your gas cylinder and pressurise the tank to 1 bar. Firstly, wind the VPRV down to its fully closed position (clockwise). Then open the 3-way valve. Close the 3-way valve when the tank is at 1 bar and watch for a pressure drop. If the seal is in place properly and the lid is closed, the pressure should hold. Once the seal is confirmed, you can leave the pressure in the vessel, but re-set the VPRV to your chosen set-point e.g. 2½ turns open (anti-clockwise).
2. It is possible the VPRV could be leaking. Obtain a children's party balloon and place over the VPRV. If the balloon expands, the VPRV is leaking and needs attention. Release gas from the VPRV by pressing the VPRV release button and then unwind the VPRV fully. Examine the seal and spring for faults or obstructions or grit and clean. Examine the VPRV cavity for any obstructions or grit and remove if need be. Replace the VPRV with the seal and spring in their correct positions and monitor the pressure. If pressure still doesn't build up, call the local help desk.

PROBLEM 3:
I CAN'T QUITE GET THE PRESSURE RIGHT WITH THE VPRV.

Solutions:

1. You have a few days to get the pressure right during the first days of fermentation. Set an excess pressure on the VPRV, let the pressure in the vessel build up and then turn the VPRV counter-clockwise to release pressure until your set point is reached and no more pressure is emitted at that setting. Check gas is released out the VPRV as the pressure goes past your desired set-point and then leave the VPRV set at that mark.
2. Just ferment at a pressure higher than your target. The yeast should ferment all the way even at high pressures and you can release excess pressure later.

STAGE FOUR:
COOLING

PROBLEM 1:
THE COOLING DOESN'T SEEM TO WORK.

Solutions:

1. Check you have the brewery turned on. If not, turn it on.
2. Check you have set the correct temperature and that it is lower than the ambient temperature. If not, set the correct temperature.
3. Check the yellow refrigeration light is lit up on the temperature controller LED readout. This should read SUB2. If the set-point is more than 1°C lower than the actual temperature this text should be lit up on the controller screen. If it is lit up and the temperature is not falling, there may be an issue with the compressor or a small pump that circulates the glycol. Call the local help desk.

STAGE FIVE:
CLARIFICATION

PROBLEM 1:
I CAN'T MIX THE CLARIFICATION AGENT INTO THE BEVERAGE

Solution:

Read Appendix 8 carefully for principles regarding clarification. Ensure that the gas cylinder pressure is 0.5 bar (7 psi) higher than the vessel pressure. Then ensure there is clarification agent inside the clarification pot. Then turn the 3-way valve to the pot and listen for the sound of mixing. If there is still no mixing either increase the pressure from the gas bottle or decrease the pressure in the vessel until mixing is heard. It could be one of the gauges is reading incorrectly.

Other causes could be a blocked one-way valve under the pot inside the tower or a blocked beer line (if hops or malt has been added and particles are blocking the lines). Call the local help desk for advice.

PROBLEM 2:
THE BEVERAGE IS NOT 100% CRYSTAL CLEAR AFTER 2 CLARIFICATIONS

Solution:

The clarification agent WilliamsWarn uses should easily clear S-33, S-23, W34/70 and Nottingham yeasts. If beers produced by these yeasts do not clear, then check you are mixing the agent properly and that vigorous bubbling is heard during the clarification process. If mixing is proper then any unclear beverage using these yeast may be a random biological occurrence or extra ingredients added (via the Advanced Method) are making the beverage harder to clear. The haze in this case may be small hop or malt particles that are difficult to clear. Try an extra clarification with 30ml but be aware small hops or malt particles may not react with our fining agent.

T-58 yeast may sometimes be difficult to clear so in these cases you can try:

1. An extra clearing with 30ml
2. Give the beverage more time to clear
3. Enjoy a slightly cloudy beverage
4. Or experiment with an alternative finings agent

Other yeast used will vary in their ability to be cleared with our finings agent. If crystal clear beer is important to you then chose yeast that are easy to clear with our agent or find another liquid agent to dose.

STAGE SIX:
DISPENSE

PROBLEM 1:
THE BEVERAGE IS FOAMING TOO MUCH

Solutions:

1. Ensure you are pulling the tap handle not pushing it. Pushing the tap handle creates foam (its used for the last part of a beer pour). Pull the tap handle instead of pushing it.
2. Ensure you have the tap flow controller fully closed (pushed up) before you pull the tap handle and then slowly open it to start with a slow pour. The first pour of the day can be foamy due to the line being warmer than the vessel and the carbon dioxide coming out of solution in the line.
3. Ensure the draft tap is pulled out fully when pouring.
4. Ensure the beverage is cold.
5. Ensure the beverage wasn't fermented at an extreme pressure or is being dispensed at a too high pressure. Release excess pressure from the vessel via the VPRV button and set at 1 bar and try pouring again. You may need to wait for excess gas in the beverage to move out of the beverage over time (e.g. 1 day). Try to control the pour with the control level and pour slowly.

PROBLEM 2:
THE PRESSURE IN THE TANK SEEMS TO BE FALLING

Solutions:

1. Ensure that the gas cylinder is connected to the vessel during dispense. The 3-way valve should be turned to the arrow pointing to the vessel pressure gauge during dispense. If not, as you pour the pressure in the vessel will reduce.
2. Check the gas cylinder has pressure on its high and low pressure gauges and isn't empty. If it is then connect a full gas cylinder.
3. Close the 3-way valve (X position), record the vessel pressure and don't pour any beer for 24 hours. Read the pressure again. If there is a major reduction you may have a leaking seal or VPRV. See solutions 1 and 2 for Problem 2 in Stage 3 above.

PROBLEM 3:
THE BEVERAGE FLOW IS SLOW

Solutions:

1. Ensure the tank pressure is adequate. At 1.25 bar a fast flow can be achieved when the flow control lever is fully open and the tap pulled fully towards you.
2. Ensure the flow control lever is pushed down enough to open and allow a flow.
3. Ensure the draft tap is being pulled all the way to its fully open position.